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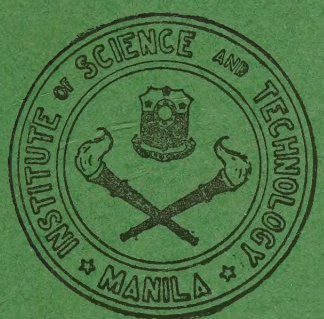

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THE PHILIPPINE JOURNAL OF SCIENCE

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STUDIES ON THE PREPARATION OF CASTOR OIL-BASED HYDRAULIC BRAKE FLUIDS

BY AURELIO O. CRUZ, ANGELITA M. TUASON, and CORAZON M. MENDOZA
Institute of Science and Technology, Manila

Castor oil which is obtained from the seeds of *Ricinus communis* can be produced from local varieties growing either wild or in cultivation in many parts of the Philippines. In the manufacture of medicinal castor oil by cold pressing, the cake obtained, when subjected to further pressing with either heat or solvent extraction, still yields considerable amount of oil of industrial grade. Because of its unique and versatile character, several investigations on the castor oil molecule have been undertaken aimed at altering its chemical nature and converting it into useful and desirable products. McIntyre(5) reports that one castor oil producer sells 185 products made from castor beans and that he has about 100 other products in the development stage.

Perhaps one of the most distinct uses of castor oil is in the manufacture of hydraulic brake fluids. Considered one of the earliest fluids used in the brake system, it proves relatively better than other fluids. The first hydraulic brake fluid, which consisted simply of castor oil and ethyl alcohol, was invented by Longhead.(3) Although used quite extensively for many years, it possessed two serious disadvantages. It was very volatile and was corrosive to aluminum alloy, copper and brass parts of brake mechanisms. These problems prompted several workers to produce a less volatile, non-corrosive fluid.

According to Fulton,(1) castor oil is perhaps the only oil of the commercial varieties available whether animal, vegetable, marine or mineral, that is suitable for use as lubricant in, or to impart, "body" to, brake fluids. It is the only known,

lubricant that does not have a deleterious action on rubber, is non-drying, has a low solidification point (–17°C), and will withstand quite high temperature before suffering pyrogenic decomposition. It possesses to a high degree all the properties of the lubricant requirement of hydraulic brake systems. Because of its low viscosity at low temperature, castor oil cannot be used alone and hence must be diluted with solvents. The characteristics of a good vehicle for castor oil is therefore discused with considerable emphasis and a list of chemicals as possible solvents is presented.

Inman(2) reports that one disadvantage of castor oil as a lubricant is that it becomes oxidized with age and causes undesirable corrosion with its increase in acidity. Several compounds were tried as antioxidants and their anti-oxygenic activity towards castor oil was measured by the corresponding rise in acidity of the oil.

Shough(6) describes the properties of various blends of castor oil and compares these with samples of commercial fluids. He reports that glycols reduce the attack on rubber and that aliphatic amine phosphates are effective corrosion inhibitors.

Markey(4) describes the chemical and physical properties of brake fluids for safe vehicle operation. He lists a number of brake-fluid substances used as lubricants, diluents, and inhibitors. He also briefly discussed the development of brake fluids provoked by changes in automotive designs affecting brakes and the advent use of synthetic rubber.

Prior to the second World War there was no published set of specifications for brake fluids and there were no standard procedures for their evaluation. Fulton(1) attempted to list the requirements of an ideal brake fluid, which may be summarized as follows:

1. The fluid must be stable in composition—i.e., invariable with time.
2. It must be non-injurious to metals of the brake system and to rubber.
3. Change of viscosity with change of temperature should not be excessive.
4. It should be relatively nonvolatile. An initial boiling point of at least 105°C is desirable.
5. It should be entirely fluid at low temperatures and not solidify or crystalized above—50°C.
6. It should lublicate satisfactorily all moving internal parts of the brake system, even at high pressures.
7. It must be miscible with all standard brake fluids and preferably with all fluids being sold.
8. The materials used in its formulation should be readily available in commercial quantities at a cost commensurate with its use.

With the growing complexity of the brake system brought about principally by new developments in metallurgy and the use of synthetic rubber, the apparent importance of the brake system to modern types of transportation has become more real. Because of the increase in serious accidents due to brake failures, the United States Army in 1942 set up a table of specifications for brake fluids, but since these were for heavy-duty brake fluids only, the Society of Automotive Engineers in 1945 prepared the SAE (Society of Automotive Engineers) Handbook directed towards proper brake performance both for moderate-duty and heavy-duty types.

The various fields of studies undertaken by several workers show that the formulation, of an ideal hydraulic brake fluid entails a number of considerations, if safe driving is to be expected. Profiting from the results of their works, we intended to make our own formulations, using locally produced industrial castor oil in admixture with appropriate solvents which, as much as possible, may also be obtained locally.

Perhaps coincident with the possibility of utilizing our local raw materials is the fact that the Philippines, based on her 1953 importation figures, imports almost one-half million pesos worth of hydraulic brake fluids, which would be a considerable saving to the country if this product could be prepared locally.

EXPERIMENTAL PROCEDURE

Moderate duty-type hydraulic brake fluid.—With the SAE(7) specifications as bases, several mixtures were prepared using castor oil processed in the Institute and various solvents in different proportions for the purpose of having a formula which would suit local conditions. The preparations were then tested if they conform to SAE specifications for moderate duty-type hydraulic brake fluid, following the prescribed procedures for their evaluation in the SAE Handbook, 1949. In the tests, viscosity, boiling point, flash point, neutrality, corrosion, stability, rubber swelling and evaporation were determined. For lack of complete equipment, no tests for lubrication and residue were performed. Tests which required very low temperature, like cold test and test for water tolerance and compatibility, were neither undertaken, since problems on these are not likely to be encountered in the Philippines where low temperatures hardly occur.

Formulas evolved for moderate duty-type hydraulic brake fluids with 0.1 per cent hydroquinone are shown in Table 1.

TABLE 1.—*Formulas for moderate duty-type hydraulic brake fluids with 0.1 per cent hydroquinone.*

Constituents	Per cent
I. Castor oil	26.7
Butyl alcohol	66.7
Ethylene glycol	6.6
II. Castor oil	50.0
Ethyl alcohol	50.0
III. Ethyl ricinoleate	100.0
IV. Castor oil	26.7
Isopropyl alcohol	66.7
Ethylene glycol	6.6

Results of tests on the different formulations, as compared with the SAE standards, are given in Table 2. As shown in the table, a mixture consisting of equal parts of IST castor oil and ethyl alcohol do not conform with some of the requirements of the Society of Automotive Engineers Standard Specifications for any type of hydraulic brake fluid.

TABLE 2.—*Tests on formulas for moderate duty-type hydraulic brake fluids with 0.1 per cent hydroquinone as antioxidant.*

Formulas	Viscosity (kinematic) min.		Boiling point	Flash point	Neutrality (pH)	Neutrality after corrosion (pH)
	100 °F	130 °F				
	C.S.	*C.S.*	*°F*	*°F*		
SAE standards moderate duty-type	----------	3.5	230 min.	100 min.	5.0–9.5	5.0–9.5
1	7.4	4.8	248.0	106	5.75	5.5
2	12.2	7.9	177.8	69	5.85	6.0
3	31.5	16.9	186.8	395	3.25	5.5
4	7.4	5.6	191.3	65	7.35	7.5

Formulas	Corrosion	Stability	Rubber swelling	Evaporation	
		°F		*Per cent*	
SAE standards moderate duty-type	Not more than permissible corrosion loss.	225.0 min.	Increase in diameter: .005–0.05 in.		85.0 max.
1	Passed test	248.0	Within limits		70.1
2	Failed test	177.8	Within limits		44.6
3	Failed test	435.2	Failed test	Oily residue	2.4
4	Failed test	264.2	Within limits	Solid residue	68.6

Substitution of ethyl alcohol in the mixture with isopropyl alcohol did not improve its properties.

Ethyl ricinoleate, when similarly tested did not conform to the SAE specifications for any type of hydraulic fluid.

The preparation consisting of castor oil, butyl alcohol, and ethylene glycol with 0.1 per cent hydroquinone conformed with the requirements for a moderate duty-type hydraulic brake fluid. According to SAE specifications this can be used for cars and small trucks.

Heavy duty-type hydraulic brake fluid.—A good brake fluid is even more needed in heavy-duty brake mechanisms such as those in big trucks and airplanes. For airplanes, castor oil-based hydraulic brake fluids seem to be most favored for reasons that need not be mentioned here. We have also attempted to prepare several mixtures with the use of IST castor oil and solvents of high boiling points which have been presented in several articles as possible vehicles for this type of brake fluid.

Table 3 shows the preparations made, following the requirements of the SAE standards. A uniform formula, consisting

TABLE 3.—*Formulas for heavy duty-type hydraulic brake fluids with 0.1 per cent hydroquinone.*

Constituents	Per cent
A. Castor oil	50.0
Diacetone	50.0
B. Castor oil	50.0
Dipropylene glycol	50.0
C. Castor oil	50 0
Diacetone	25.0
Dipropylene glycol	25.0
D. Castor oil	50.0
Butyl carbitol	50.0
E. Castor oil	50.0
2-Methyl 2, 4, pentanediol	50.0
F. Castor oil	100.0

of equal parts of IST castor oil and solvent, with 0.1 per cent hydroquinone, except for Formula C, wherein two solvents were used, was adopted for all mixtures. These were similarly tested according to the SAE procedures, the results, compared with the standard requirements, being presented in Table 4.

As shown in this Table, four of the formulas were found to comply with SAE specifications for heavy duty-type hydraulic

TABLE 4.—*Tests on formulas for heavy duty-type hydraulic brake fluids with 0.1 per cent hydroquinone as antioxidant.*

Formulas	Viscosity (kinematic) min.		Boiling point	Flash point	Neutrality (pH)	Neutrality after corrosion (pH)
	100°F	130°F				
	C.S.	*C.S.*	*°F*	*°F*		
SAE standards heavy-duty type	----------	3.5	300 min.	145 min.	6.0–9.5	6.0–9.5
A	18.42	11.0	302	145	6.0	6.0
B	86.0	30.0	374	210	6.0	6.0
C	44.5	22.0	324	184	6.0	6.0
D	25.3	13.2	401	265	6.1	6.1
E	68.7	30.8	374	209	6.0	6.0
F	277.4	108.0	527	Over 300	6.0	6.0

Formulas	Corrosion	Stability	Rubber swelling	Evaporation
		°F		*Per cent*
SAE standards heavy-duty type	Not more than permissible corrosion loss.	295 min.	Increase in diameter: 0.005–0.05 in.	80.0 max.
A	Passed test	257	Within limits	10.0
B	Passed test	428	Within limits	9.2
C	Passed test	302	Within limits	12.4
D	Passed test	442	Within limits	9.2
E	Failed test for tin and steel	365	Within limits	10.4
F	Failed test for steel, aluminum, and brass	527	Within limits	0.6

brake fluid. Formula A failed in the stability test, but this deficiency can easily be remedied by adding any known stabilizer.

Also included in this table is Formula F which consists only of castor oil and 0.1 per cent hydroquinone. This particular preparation was included and tested considering that the use of castor oil alone as a hydraulic brake fluid has been tried by others. Their only objection to it is its too low viscosity at low temperatures, Despite this objection the use of castor oil alone should not be a local problem since very low temperatures do not obtain here. Our tests indicate that if an anti-corrosion substance is added, Formula F will pass the required standard specifications, except in its relatively high solidification temperature (0°F) and its high viscosity at low temperature. In the Philippines, as in other tropical countries, these problems are not likely to be encountered. In our opinion pure castor oil with an anti-oxidant and an anti-corrosion substance added to it can very well served as an ideal heavy duty-type hydraulic brake fluid.

SUMMARY

The results of the experiments performed indicate that a moderate duty-type hydraulic brake fluid for pleasure cars and small trucks, which passes SAE specifications may be prepared from a mixture of castor oil, butyl alcohol, and ethylene glycol with 0.1 per cent hydroquinone.

Five formulas were prepared using equal parts of castor oil and solvent, with 0.1 per cent hydroquinone. These were tested and found to comply with SAE specifications for heavy duty-type hydraulic brake fluid except formula A, which failed in the stability test. Another preparations consisting of castor oil only and 0.1 hydroquinone was also tested and except for its relatively high solidifying point (0°C) and low viscosity at low temperatures was found up to all SAE requirements. The experiments showed that castor oil alone with an anti-oxidant added to it can serve as an ideal heavy duty-type hydraulic brake fluid in tropical countries.

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FLUCTUATIONS IN THE PLANKTONIC POPULATION OF THE ESTUARIES OF NAVOTAS AND MALABON [1]

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FOUR PLATES AND SIX TEXT FIGURES

INTRODUCTION

A comprehensive analysis of the possible factors and influences operating in the natural waters of a certain locality is an essential approach to the study of the interrelationship existing between an organism and its environment. These factors, physico-chemical in nature, make possible varying degrees of biological productivity in different ecological units. Plant and animal plankton, at one stage or another in their life histories, constitute a major source of food supply for larger marine, fresh-water, and estuarine species which in turn are utilized by the much larger forms; they thus play an important role in the nutritive scheme of aquatic life. On the other hand, the bigger organisms provide substances necessary for the growth and nutrition of the plankton.

This investigation aims to determine the influence of the various environmental factors on the fluctuations of the planktonic population of the locality under study and to correlate the appearance and disappearance, migration, occurrences of plankton blooms, peaks of reproduction and diurnal migrations of the plankton on such factors as rainfall, salinity, pH, cloud coverage, light intensity, temperature, wind velocity, and humidity. Variability of these factors affects the physiology of the plankton. These causative influences determine the biological productivity of a given body of water.

Very few investigations of this nature have been done in the Philippines. Two prominent works on Philippine plankton have been written by Roxas (1941) and Mann (1925), but these were studies on the taxonomy and morphology of the plankton. No local study on the causes and effects of fluctuations of planktonic population of a certain body of water has

[1] Abstract of thesis submitted in partial requirement for the degree of Master of Science in Zoology, Graduate School, University of Santo Tomas, April, 1954.

ever been published. There are, however, various foreign works accomplished along this line.

The lagoon of Navotas and Malabon municipalities, Rizal Province, surrounding the Dagatdagatan Salt-water Experimental Station of the Philippine Bureau of Fisheries served as the center of this research, which was conducted from April 16, 1951 to February 18, 1952. Standard laboratory and field procedures were used in the collection and examination of samples and in the analysis and synthesis of data. The data for rainfall, wind velocity, tides, and humidity were taken from the meteorological station of the locality and the central office of the Philippine Weather Bureau.

RESULTS AND DISCUSSION

A total of 27 plankters were identified throughout the course of the investigation, 18 of which were diatoms; 4, dinoflagellates; 2, members of the blue-green algæ; and 3, representatives of the zooplankton group: namely, copepods (Plate 2, fig. 14), tintinids (Plate 1, fig. 9), and annelid larvæ (Plate 4, fig. 27).

These organisms which constitute the common groups of plankton found occurring in the locality under study are shown in the following:

I. Bacillarieæ (Diatoms):	Total for period	Occurrence *Per cent*	Composition *Per cent*
1. *Rhizosolenia*	3,018,040	25.0	1.1
2. *Surirella*	6,979,310	62.6	2.6
3. *Coscinodiscus*	52,627,720	100.0	19.3
4. *Fragilaria*	188,630	3.1	0.0007
5. *Chaetoceros*	67,152,250	40.6	25.2
6. *Pinnularia*	2,829,450	25.0	1.1
7. *Synedra*	2,829,450	21.8	1.1
8. *Nitzschia*	29,805,780	59.4	11.2
9. *Navicula*	19,240,230	90.7	7.2
10. *Pleurosigma*	20,183,370	87.6	8.2
11. *Gomphonema*	25,276,400	81.2	9.4
12. *Cyclotella*	7,167,980	56.3	2.6
13. *Tabellaria*	1,697,660	6.2	6.3
14. *Amphipleura*	754,520	12.5	0.002
15. *Eucampia*	188,630	3.1	0.0007
16. *Biddulphia*	377,260	6.2	0.001
17. *Melosira*	4,338,540	15.6	1.4
18. *Tricratium*	1,131,800	3.1	0.425

	Total for period	Occurrence *Per cent*	Composition *Per cent*
II. Dinophyceæ (Dinoflagellates):			
1. *Noctiluca*	4,904,350	25.0	1.8
2. *Ceratium*	1,509,060	6.2	0.60
3. *Prorocentrum*	754,520	3.1	0.0028
4. *Peridinium*	754,520	9.3	0.0028
III. Myxophyceæ (Nostocaceæ):			
1. *Anabaena*	2,074,890	9.3	1.0
2. *Anabaenopsis*	565,890	3.1	0.002
IV. Zooplankton (animal organisms):			
1. *Crustacea* (copepods)	2,074	25.0	0.001
2. *Infusoria* (ciliate protozoa)	4,754,520	12.5	0.002
3. *Annelida* (annelid larvæ)	3,772,590	9.3	1.4
Total	266,144,600		

The above shows that diatoms constitute the dominant composition of the plankton. Some of the diatoms such as *Eucampia* (Plate 3, fig. 22), *Fragilaria* (Plate 3, fig. 16), *Triceratium* (Plate 4, fig. 25), *Tabellaria* (Plate 4, fig. 26), *Biddulphia* (Plate 3, fig. 21), and the dinoflagellates are not common in the region and may be considered adventitious plankters which are accidentally introduced into the area by strong storm waves, rising tides, floods, and other disturbances or are carried therein from the Navotas and Malabon rivers which feed the lagoon. The Tanza River joins the Malabon River from the north, and esteros from Balut and Caloocan and surrounding areas empty into the estuarine bay. These rivers are generally laden with silt which favors diatom growth because of its high silica content.

Coscinodiscus (Plate 1, fig. 1), *Gomphonema* (Plate 2, fig. 13), and *Navicula* (Plate 1, fig. 6), made the greatest percentage of appearance in all the samples, followed by *Cyclotella* (Plate 2, fig. 10), *Pleurosigma* (Plate, 2 fig. 11), *Nitzschia* (Plate 3, fig. 15), and *Surirella* (Plate 1, fig. 2). Among the dinoflagellates or peridines, *Noctiluca* (Plate 1, fig. 8), appeared in April, May, July, October, November, December, and January. *Peridinium* (Plate 3, fig. 23) appeared in June and July; *Prorocentrum*, (Plate 1, fig. 7) in June; *Anabaena* (Plate 3, fig. 20), in May, June and January; and *Anabaenopsis* (Plate 3, fig. 18), only in September. Annelid larvæ appeared in significant quantities in June; whereas copepods made six appearances: in May, August, October, December, January, and February. All other diatoms made a few occasional appearances.

TABLE 1.—*Monthly occurrence of plankton.*

Plankton	April	May	June	July	August	September
Rhizosolenia	188,630	377,260		188,630		1,509,000
Suirella	565,890	754,520	943,150	754,520	377,260	
Coscinodiscus	4,149,900	2,263,560	6,224,690	10,563,280	3,018,050	188,630
Fragilaria	188,630					
Chaetoceros	10,940,500	943,150	35,839,720	18,297,100	188,630	188,630
Noctiluca	943,150	188,630		943,150		
Pinnularia	565,890		565,890	188,630		
Synedra	1,697,700				188,630	
Nitzschia	9,608,000	3,395,360		565,890	8,488,330	188,630
Navicula	1,131,800	1,320,410	943,150	2,263,580	943,150	188,630
Pleurosigma	377,260	565,890	943,150	754,520	1,320,410	
Gomphonema	188,630	565,890	1,697,670	8,488,320	2,452,160	1,131,160
Cyclotella	188,630	188,630	377,260	377,260	2,263,600	
Anabaena		188,630	1,509,000			
Copepod		188,630			188,630	
Tabellaria		377,260		1,320,400		
Tintinid			377,260	377,260		
Annelida			4,527,190			
Ceratium			377,260	1,131,800		
Prorocentrum			754,520			
Amphipleura			188,630			
Peridinium				188,630		
Eucampia				188,630		
Biddulphia				188,630		188,630
Anabaenopsis						565,890
Melosira						
Triceratium						

Plankton	October	November	December	January	February	Total
Rhizosolenia	377,260		188,630			2,829,410
Surirella	754,520	1,509,040	377,260	943,150		6,979,310
Coscinodiscus	11,506,510	4,904,390	2,263,560	5,470,250	2,074,900	52,627,720
Fragilaria						188,630
Chaetoceras	188,630			565,890		67,152,250
Noctiluca	377,260	188,630	2,074,900	188,630		4,904,350
Pinnularia	377,260		377,260	565,890	188,630	2,829,450
Synedra	188,630	188,630	188,630	277,260		2,829,480
Nitzschia	4,905,380	565,890	565,890	754,520	565,890	29,603,780
Navicula	3,395,350	2,263,520	3,206,710	2,829,410	755,520	19,241,230
Pleurosigma	6,602,110	2,074,890	3,583,890	3,206,730	754,520	20,183,370
Gomphonema	2,829,450	3,018,110	2,263,550	1,697,670	943,150	25,275,760
Cyclotella	1,509,040	1,131,780	565,890	188,630	377,260	7,167,980
Anabaena				377,260		2,074,890
Copepod	754,520		377,260	377,260	188,630	2,074,930
Tabellaria						1,697,660
Tintinid						754,520
Annelida						4,527,190
Ceratium						1,509,060
Prorocentrum						754,520
Amphipleura		188,630	188,630	188,630		754,520
Peridinium	188,630			377,260		754,520
Eucampia						188,630
Biddulphia						377,260
Anabaenopsis						565,890
Melorisa	565,890	377,260	3,395,390			4,338,540
Triceratium				1,131,800		1,131,800

Most of the plankton diatoms are pelagic in nature and the diversity of their shapes presents an efficient adaptation to a free-floating existence. These shapes are the flat, discoid form of many centric diatoms like *Coscinodiscus,* the needle shape of *Nitzschia, Rhizosolenia* (Plate 1, fig. 3), and *Synedra* (Plate 1, fig. 4), and the long filaments, sometimes spirally coiled, of *Eucampia,* and of Melosira. In *Cyclotella,* some silicified bristles

which arise from the valve edges of long horns increase its surface. The dinoflagellates found in the investigation included *Ceratium* (Plate 4, fig. 24), *Peridinium, Prorocentrum,* and *Noctiluca* but did not occur in significant quantities.

TABLE 2.—*Phytoplankton population as affected by rainfall salinity and pH.*

Date collected	Plankton population	Rainfall	Salinity	pH
		Inches		
April 16, 1951	30,745,980	0	15.5	8.7
May 2, 1951	4,904,400	1.79	15	8.3
May 11, 1951	1,697,670	0	12	7.8
May 21, 1951	3,956,230	0	13	7.9
May 28, 1951	943,150	0	13	8.5
June 4, 1951	20,560,700	0	15	8.3
June 11, 1951	24,510,450	0.02	13	8.5
June 18, 1951	4,904,340	0.43	11	8.5
June 25, 1951	4,333,450	0.48	10	7.8
July 10, 1951	17,353,940	0.01	11	7.9
July 17, 1951	9,431,520	T	11	8.5
July 24, 1951	4,715,760	0.15	10	7.9
July 30, 1951	15,288,910	1.39	11	8.2
August 7, 1951	12,260,800	0.12	2	7.7
August 13, 1951	5,092,980	2.16	2	7.6
September 27, 1951	6,979,290	0	10	7.9
October 2, 1951	7,167,980	0.11	9	7.9
October 9, 1951	6,602,100	0	9	7.9
October 16, 1951	7,922,550	0.17	6	8.4
October 23, 1951	6,979,320	0	5	7.9
October 27, 1951	8,111,080	0	10	8.5
November 5, 1951	4,904,410	0.77	10	8.0
November 12, 1951	8,676,910	0	9	7.9
November 19, 1951	2,829,450	0	9	7.9
December 3, 1951	6,602,000	1.64	4	7.7
December 10, 1951	6,413,350	0.21	6	8.4
December 24, 1951	6,602,100	0.03	8	8.5
January 2, 1952	4,715,720	0.00	12	8.6
January 14, 1952	4,338,520	T	10	7.8
January 21, 1952	6,036,200	0	12	8.4
January 28, 1952	4,149,850	0	14	7.9
February 18, 1952	6,413,390	0	18	7.9

Tides and ocean currents and plankton production.—The estuaries of Navotas and Malabon municipalities are sheltered in some places and quite shallow, so hydrographic conditions appear to be generally normal and the effect of the rise and fall of tides is scarcely felt. The highest tide mark which occurred on June 4 was 170 cm and the corresponding production was 20,560,700 per cubic meter of water. June 11 saw a drop in the tide mark to 100 cm with a corresponding rise to a peak in plankton number, 24,510,450 per cubic meter of water. On June 18, the tide mark continued to rise and a big drop in the plankton number, 4,904,340, was seen. Another condition was presented by the lowering of the tide level from 160 to 73 cm from July 24 to July 30 with a corresponding big increase in plankton number from 4,715,760 to 15,288, 910, another peak in increases. On July 30 the tide went up to 1.5 meters, marking a decline in plankton number from 15,288,910 to 12,260,900 on

August 7 and 5,092,980 on August 13. This indicated that rising tide levels caused significant decreases in plankton population. Recovery and increases in plankton number was noticed during the falling of tides. Stability in hydrographic conditions favored increases in plankton production. This investigation also proves that current and a faster rate of water replacement adversely affect plankton production. During the stormy period of August 7 to August 13, there was a drop in plankton number from 12,260,900 to 5,092,980 due to typhoon "Marge" accentuated with occurrences of thunderstorms.

TABLE 3.—*Plankton population as affected by temperature cloud coverage, and tide.*

Date collected	Plankton population	Temperature		Cloud coverage	Tide
		Air	Water		
		°C	°C		
April 16, 1951	30,745,980	26.5	27	6	H
May 2, 1951	4,904,400	26.5	27	7	L
May 11, 1951	1,697,670	27.5	28	9	H-1.0
May 21, 1951	3,956,230	28	30	7	H- .15
May 28, 1951	943,150	29	30.5	6	H- .90
June 4, 1951	20,560,700	29	32	6	H-1.70
June 11, 1951	24,510,450	29.5	31	8	H-1.0
June 18, 1951	4,904,340	28	30	10	H-1.7
June 25, 1951	4,333,450	27.5	30	7	H- .85
July 10, 1951	17,353,940	28.5	28.7	8	H- .60
July 17, 1951	9,431,520	28	30	9	L-1.6
July 24, 1951	4,715,760	28	30	8	H- .73
July 30, 1951	15,288,910	29	29.7	10	L-1.5
August 7, 1951	12,260,900	28.5	29	10	H- .70
August 13, 1951	5,092,980	26	27	10	H
September 27, 1951	6,979,290	28.5	32	5	L-1.24
October 2, 1951	7,167,980	28	30.5	9	H- .70
October 9, 1951	6,602,100	30	33	4	L- .60
October 16, 1951	7,922,550	28	29	8	L- .70
October 23, 1951	6,979,320	28	31	5	H- .80
October 27, 1951	8,111,080	28	31	5	H- .70
November 5, 1951	4,904,410	30	28	9	H- .80
November 12, 1951	8,676,910	26.5	29.5	6	H- .65
November 19, 1951	2,829,450	28	29.5	6	H- .40
December 3, 1951	6,602,000	26.5	26	10	L- .50
December 10, 1951	6,413,350	28	29	9	L- .60
December 24, 1951	6,602,100	25.5	29	8	H- .20
January 2, 1952	4,715,720	27	28	7	L-0
January 14, 1952	4,388,520	26	27.5	9	L-0
January 21, 1952	6,036,200	26	26	8	L-0
January 28, 1952	4,149,850	26.5	29	6	L-0
February 18, 1952	6,413,390	26	28	6	L-0.2

pH and plankton production.—Results of this investigation show that variation in pH was within narrow limits, from 7.6 to 8.7. There were no sudden or abrupt changes. Sudden rains caused temporary alteration in pH. Plankton growth revealed a tendency toward the alkaline side. The lowest pH recorded was on August 13 (7.6) which was followed by a sudden drop of 7,167,920 in plankton number. This could be partly attributed

to typhoon "Marge" of August 10 to 18. The highest pH recorded was 8.7 and coincided with the greatest plankton count (30,745,980 per cubic meter of water) throughout the whole period of the investigation. (Fig. 1)

Temperature and plankton production.—This investigation shows that water temperature within a range of 29 to 30°C.

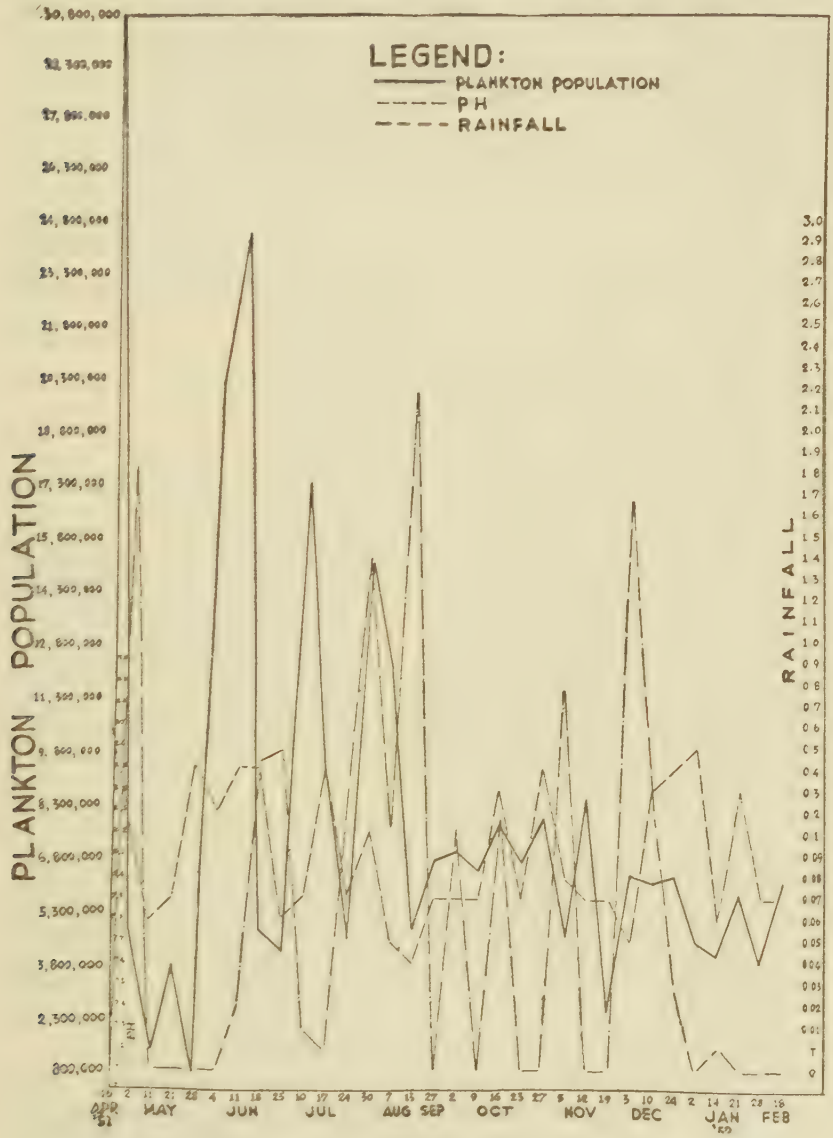

Fig. 1. Plankton population as affected by pH and rainfall.

seems to favor best planktonic growth. A rising temperature shows an increase in plankton number, but at extremely high temperatures, a sudden drop was noted. Throughout the whole period of the investigation, no excessively high temperature was recorded. Results show that each organism seem to show a range of temperature tolerance, varying according to the species. (Fig. 2)

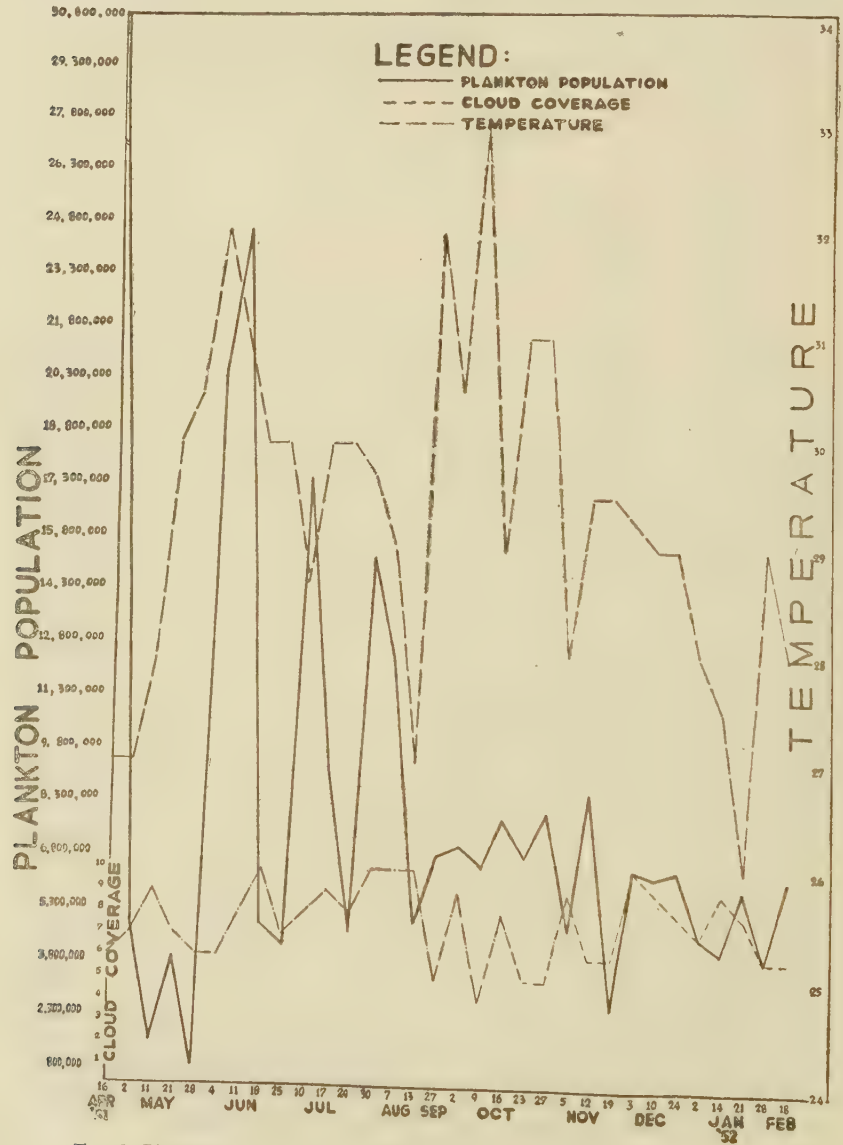

FIG. 2. Plankton population as affected by cloud coverage and temperature.

Light and plankton production.—The appearance of microscopic copepods on May 21st caused the disappearance of several diatoms: namely, *Surirella, Chaetoceros, Pinnularia, Navicula, Gomphonema,* and *Cyclotella* during the ensuing weeks. Ciliate protozoans and microcrustaceans feed on phytoplankters. The highest plankton counts were taken on April 16, 30,745,980; on June 4, 20,560,700; on June 11, 24,510,450; and on July 10, 17,353,940. Cloud coverage during these days ranged from 6 to 8 (partly cloudy). Bersamin and Abagon (1952), who investigated the chlorophyll content and organic productivity of the estuaries of Navotas and Malabon municipalities, found that the maximum growth and multiplication of plankton took occasional cloudiness. The occurrences of occasional cloudiness may be a factor in speeding up the chemical processes in organic synthesis.

TABLE 4.—*Plankton population as affected by humidity and wind velocity.*

Date collected	Plankton population	Humidity	Wind velocity	
			Prevailing direction (16–PT)	Minute speed MPH
April 16, 1951	30,745,980	63	W; SE	6,0
May 2, 1951	4,904,400	71	W; NE	6.4
May 11, 1951	1,697,670	74	S; W	4.1
May 21, 1951	3,956,230	66	W;NW; ESE	6.2
May 28, 1951	943,150	61	SE	5.2
June 4, 1951	20,560,700	66	SE	5.0
June 11, 1951	24,510,450	71	SE	5.6
June 18, 1951	4,904,340	86	SE	8.9
June 25, 1951	4,333,450	74	W	4.3
July 10, 1951	17,353,940	75	W	4.3
July 17, 1951	9,431,520	74	Variable	4.0
July 24, 1951	4,715,760	78	N	3.7
July 30, 1951	15,288,910	76	S; SW	21.6
August 7, 1951	12,260,900	76	SW	5.0
August 13, 1951	5,092,980	87	SW	13.9
September 27, 1951	6,979,290	72	W; E	4.9
October 2, 1951	7,167,980	78	Variable	4.6
October 9, 1951	6,602,100	68	NE	6.6
October 16, 1951	7,922,550	80	E	4.7
October 23, 1951	6,979,320	78	W	4.6
October 27, 1951	8,111,080	74	E	4.8
November 5, 1951	4,904,410	84	N	5.9
November 12, 1951	8,676,910	74	Variable	4.8
November 19, 1951	2,829,450	76	Variable	5.8
December 3, 1951	6,602,000	86	N	7.0
December 10, 1951	6,413,350	80	NE	9.8
December 24, 1951	6,602,100	74	NE	4.7
January 2, 1952	4,715,720	66	NE	6.2
January 14, 1952	4,338,520	76	NE	4.8
January 21, 1952	6,036,200	69	NE	8.3
January 28, 1952	4,149,850	63	E	6.6
February 18, 1952	6,413,390	65	W; SE	6.5

Chlorophyll and plankton production.—A peak in plankton production which occurred on April 16 coincided with another peak on the chlorophyll content of the plankton, registered at 2,228 mgs per cubic meter of sea water. Again on August 13,

a tremendous decline in chlorophyll content from 147.0 mg per cubic meter of sea water to 61.1 mg. per cubic meter of water together with a corresponding slash in plankton population was seen. Data for chlorophyll determinations were furnished by Bersamin and Abagon of the Philippine Bureau of Fisheries, Manila, who investigated the chlorophyll content in connection with the organic productivity of certain bodies of water in the Philippines. (Fig. 3)

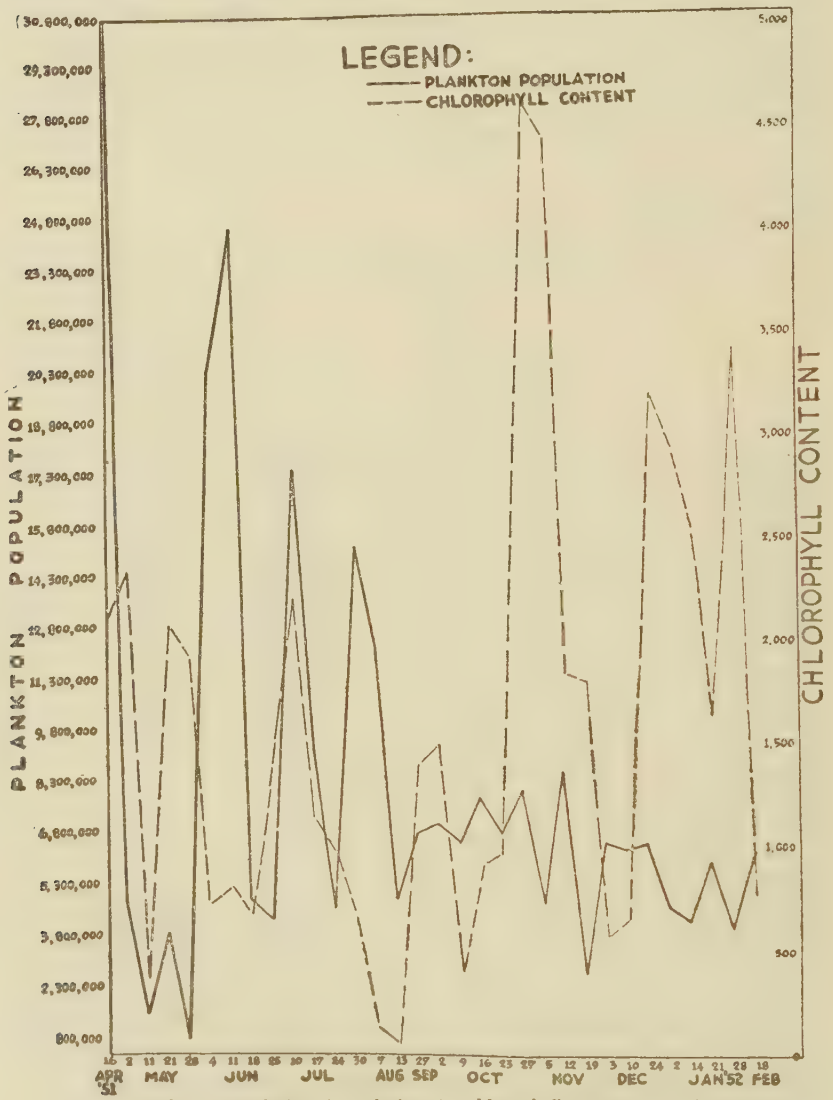

FIG. 3. Plankton population in relation to chlorophyll content of the water.

Wind velocity and plankton production.—The highest plankton count occurred on April 16 with a wind velocity of 6.2 miles per hour, southeast direction. On June 4 and 11, when the plankton counts were equally high, the wind velocity was 5.0 southeast and 5.6 southeast respectively. A low wind velocity of 5 to 6.2 miles per hour would not be considered as inimical to plankton production and distribution. On August 13, plank-

TABLE 5.—*Plankton population as affected by chlorophyll content of the water.*

Date collected	Plankton population (No. of org./ cu. m. of water)	Chlorophyll content (In mgs/ cu. m. of water)
April 15, 1951	30,745,980	2,228
May 2, 1951	4,904,400	2,705
May 11, 1951	1,697,670	377.9
May 21, 1951	3,956,230	2,194
May 28, 1951	943,150	1,931
June 4, 1951	20,560,700	741
June 11, 1951	24,510,450	827
June 18, 1951	4,904,340	684
June 25, 1951	4,333,450	1,375
July 10, 1951	17,353,940	2,237
July 17, 1951	9,431,520	1,158
July 24, 1951	4,715,760	996.5
July 30, 1951	15,288,910	632.7
August 7, 1951	12,260,900	147
August 13, 1951	5,092,980	61.1
September 27, 1951	6,979,290	1,418.5
October 2, 1951	7,167,980	1,500.5
October 9, 1951	6,602,100	403.5
October 16, 1951	7,922,550	939
October 23, 1951	6,979,320	990
October 27, 1951	8,111,080	4,648
November 5, 1951	4,904,410	4,453
November 12, 1951	8,676,910	1,853
November 19, 1951	2,829,450	1,810.3
December 3, 1951	6,602,000	574
December 10, 1951	6,413,350	677
December 24, 1951	6,602,100	3,202
January 2, 1952	4,715,720	2,920.3
January 14, 1952	4,338,520	2,523
January 21, 1952	6,036,200	1,641
January 28, 1952	4,149,850	3,425
February 18, 1952	6,413,390	770

ton production was at an ebb and wind velocity was up at 13.9 miles per hour, southwest direction. This illustrates that winds of strong velocity acting on the surface of the water is a factor in the irregularity and horizontal distribution of surface plankton. A tremendous increase in wind velocity as seen in tropical storms is a great factor in the migration of the plankton, en masse, from one region to another. (Fig. 4)

Rainfall and plankton production.—Some correlations of plankton number with rainfall were noted. An increase of rainfall from April 16 to May 2 (from 0 to 1.79 inches) registered a big drop in plankton production from 30,745,980 to 4,904,000 per cubic meter of water. From July 10 to 24, an increase from 0.01 to 0.15 inches corresponded to a drop from 17,353,940 to

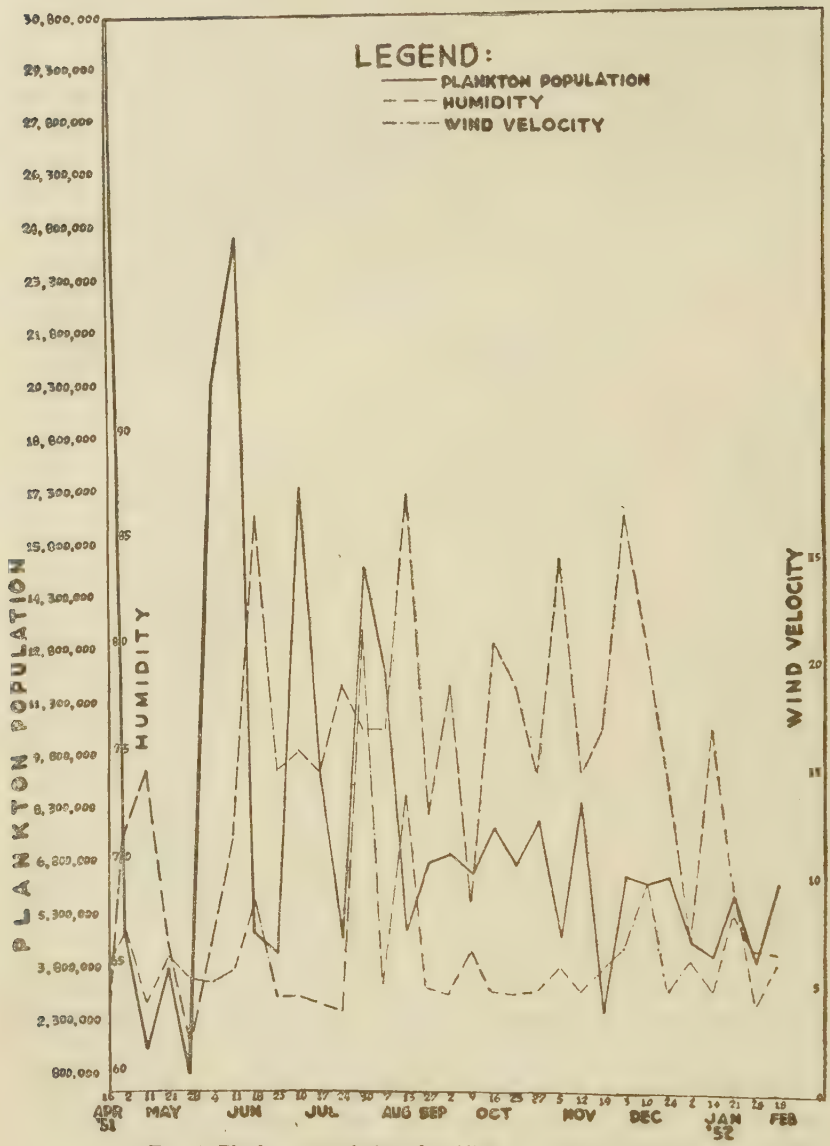

FIG. 4. Plankton population, humidity, and wind velocity.

4,715,760 in the plankton count. Then again from August 7 to 13, a gain of 2.04 inches of rainfall corresponded to a big decrease of 7,169,920 in the plankton population. (Fig. 5)

Copious rainfall causes the swelling of estuaries and increases the rate of run-off, thereby washing away a great bulk of

surface plankton. Excessive rains also increase the turbidity of the water, and decrease the rate of light penetration.

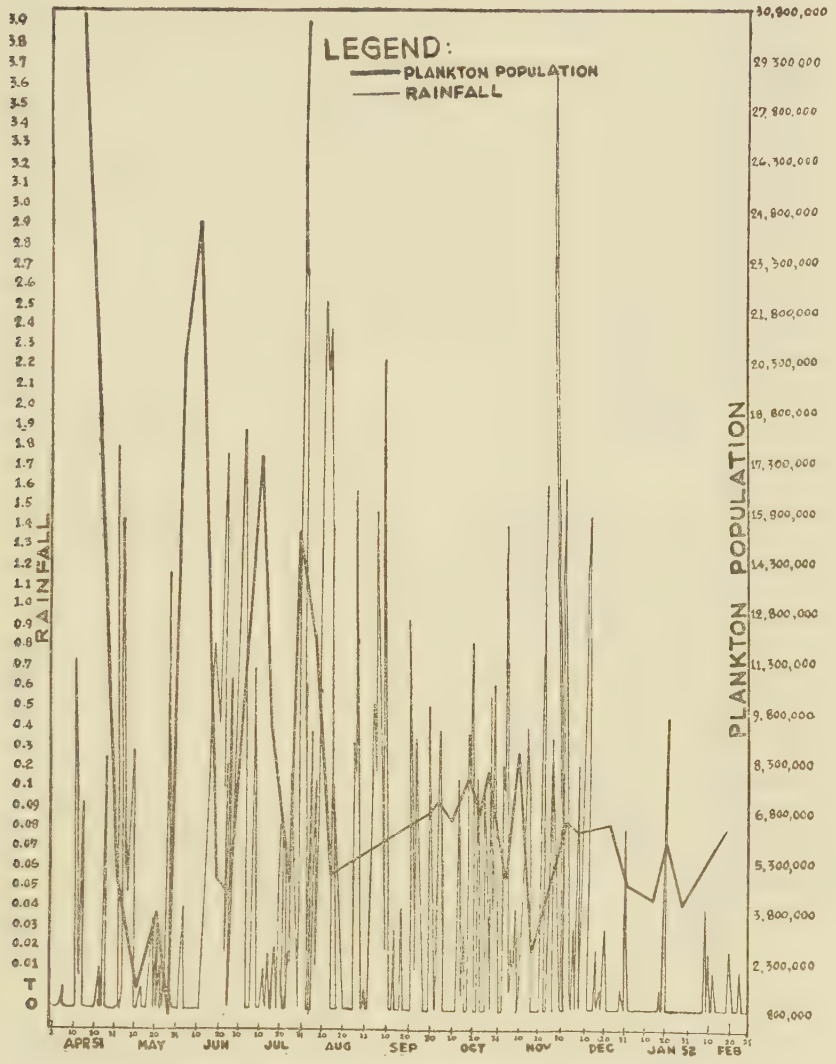

FIG. 5. Plankton population and diurnal rainfall.

Salinity and plankton production.—During the periods of greatest plankton production, namely, April 16, June 4, and June 11, the salinities were 15.5, 15, and 13, respectively. An ebb in plankton production was observed on August 7 to 13, when the salinity went down to 2 per cent. During big floods and long and abundant rains, the waters of the estuarine bay became swollen and the salinity suddenly became so low that,

the plankton suffered the abrupt change and they perished in large numbers. (Fig. 6)

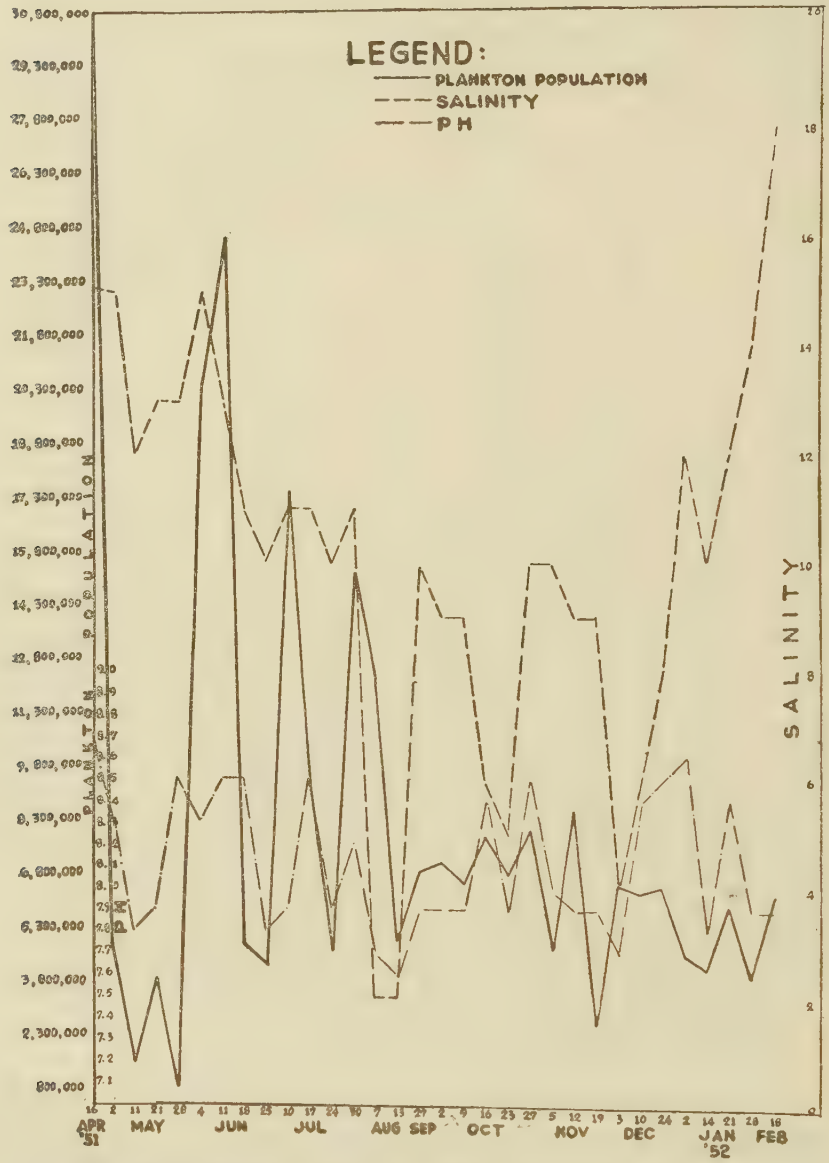

FIG. 6. Plankton population as affected by salinity and pH.

Humidity and plankton production.—Relative humidity within the range of 6.3 to 71 per cent seemed to be most favorable to ideal plankton production; but a very high relative humidity recorded on August 13 (87 per cent) showed at the same time a tremendous decrease in plankton number. Previous foreign

workers never considered humidity as an important factor which influences the production of plankton. (Fig. 4)

The area under investigation is fed with a rich supply of organic detritus coming from the canals or esteros of Caloocan and Balut including rivers and streams from the surrounding places. The abundance and copious development of these plankton diatoms are due to the large supply of nutritive salts which are washed in from the adjacent land, and to the ocean currents coming into the lagoon which are responsible for bringing abundant nutriment to the surface. It is not therefore unusual to find plankton, particularly diatoms, forming at the height of their production a thick layer composed of several millions for each cubic meter of the water surface. This condition was found to persist only for a short period of time. In many instances extreme poverty usually followed. Under favorable conditions, the abundance extended for several weeks.

Coscinodiscus seemed to be the most dominant group throughout the whole period of the investigation, although it was beaten by Chaetoceros in number. *Nitzschia* appeared in all the samples in sizeable quantities; *Gomphonema, Pleurosigma* and *Navicula* came next in abundance and periodicity of appearance. Other plankton like *Cyclotella, Surirella, Melosira* (Plate 3, fig. 19), *Rhizosolenia, Synedra,* and *Pinnularia* followed.

Diatoms were the most dominant organisms in all the samples. Since the place of investigation is an estuarine bay, there was a great probability that these diatoms must have been carried from the open seas by currents, although the physical and chemical factors of the environment favored the development and multiplication of the diatoms. The place of investigation is a shallow and stable area, and ideal factor for the constant flowering of diatoms.

It is very apparent from the results that diatom flowerings was controlled by either zooplankton grazing or by the interaction of the diatoms with the chemical and physical factors of the environment. Another explanation for the grazing phenomena is that the dominance of some small species of zooplankton suggests selective feeding as illustrated by the disappearance of some phytoplankton and the decrease in the number of others. Another probable cause of the sinking rate and continual losses on the part of the phytoplankton population is the appearance

of the dinoflagellates which have the peculiar ability of keeping themselves at or very near the surface presenting a serious competitive factor for the diatoms in the utilization of the available nutrients in the water. To maintain a population level, the phytoplankton must have to increase their reproductive capacity.

In this investigation, the law of limiting factors, being very arbitrary, may not be applied with great accuracy. In the first place the physical and chemical environmental factors do not act independently on the organisms; in the second place, the organisms are elastic in their requirements for normal existence, and when the environmental factors are favorable, growth may continue even to a point when some of the factors have become adverse.

Different organisms respond variably to different degrees of ionized hydrogen in the water. In the distribution of plankton, pH play a role. While a certain pH is favorable to some, it may be destructive to others. A more or less uniform pH favor the optimum that inclines toward alkalinity. Abundance of plankton is associated with rich bottom fauna. The place of investigation, being an estuarine bay, satisfied this condition. The area and depth within the limits of the environment showed little relation to plankton production. The quantitative production of plankton was affected by the character of the water system and rivers feeding the estuarine bay. Hazards of floods, ocean currents, and strong winds caused great mortality on the plankton composition of the locality. The blue-green algæ (*Anabæna and Anabænopsis*) had a tendency to group toward the surface, at a level higher than the level of the diatoms. This could be attributed to the greater weight of diatoms, and the need of the algæ for an abundant supply of light.

Plankton production is fundamentally based on chlorophyll content and organic productivity of the organisms.

CONCLUSION

An analysis was made on the causes of the fluctuations of the planktonic population of the locality. The physicochemical factors existing in the external environment that favored the normal production of the plankton were the following: a rich bottom fauna which was essential in the maintenance of the symbiotic relationship with plant life, an optimum pH for

plankton growth, an increased light intensity, a moderate rainfall, receding tides, inflowing from the estuary, abundance of food, absence of plankton grazers like bigger forms of aquatic animals, and hydrographic conditions which should be uniformly stable or normal.

On the other hand, the external factors found to be inimical to plankton production were: a rapid rate of water replacement or faster run-off speed of water leaving the estuary, water currents greater than the moderate speed, rising of tides, occurrence of cyclones and thunderstorms, excessive rainfall, high degree of turbidity, daily overcast conditions, exreme depths of the water, super dilution of the estuarine water from rivers during floods and typhoons, extremes in temperature, an exceedingly low pH, and very unstable hydrographic conditions.

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ILLUSTRATIONS

Plate 1

Fig. 1. *Coscinodiscus*
2. *Surirella*
3. *Rhizosolenia*
4. *Synedra*
5. *Pinnularia*
6. *Navicula*
7. *Prorocentrum*
8. *Noctiluca*
9. *Tintinid*

Plate 2

Fig. 10. *Cyclotella*
11. *Pleurosigma*
12. *Chaetoceros*
13. *Gomphonema*
14. *Copepod*

Plate 3

Fig. 15. *Nitzschia*
16. *Fragilaria*
17. *Amphipleura*
18. *Anabaenopsis*
19. *Melosira*
20. *Anabaena*
21. *Biddulphia*
22. *Eucampia*
23. *Peridinium*

Plate 4

Fig. 24. *Ceratium*
25. *Triceratium*
26. *Tabellaria*
27. *Annelid* larvæ

TEXT FIGURES

Fig. 1. Plankton population as affected by pH and rainfall.
2. Plankton population as affected by cloud coverage and temperature.
3. Plankton population in relation to the chlorophyll content of the water.
4. Plankton population as affected by humidity and wind velocity.
5. Plankton population and diurnal rainfall.
6. Plankton population as affected by salinity and pH.

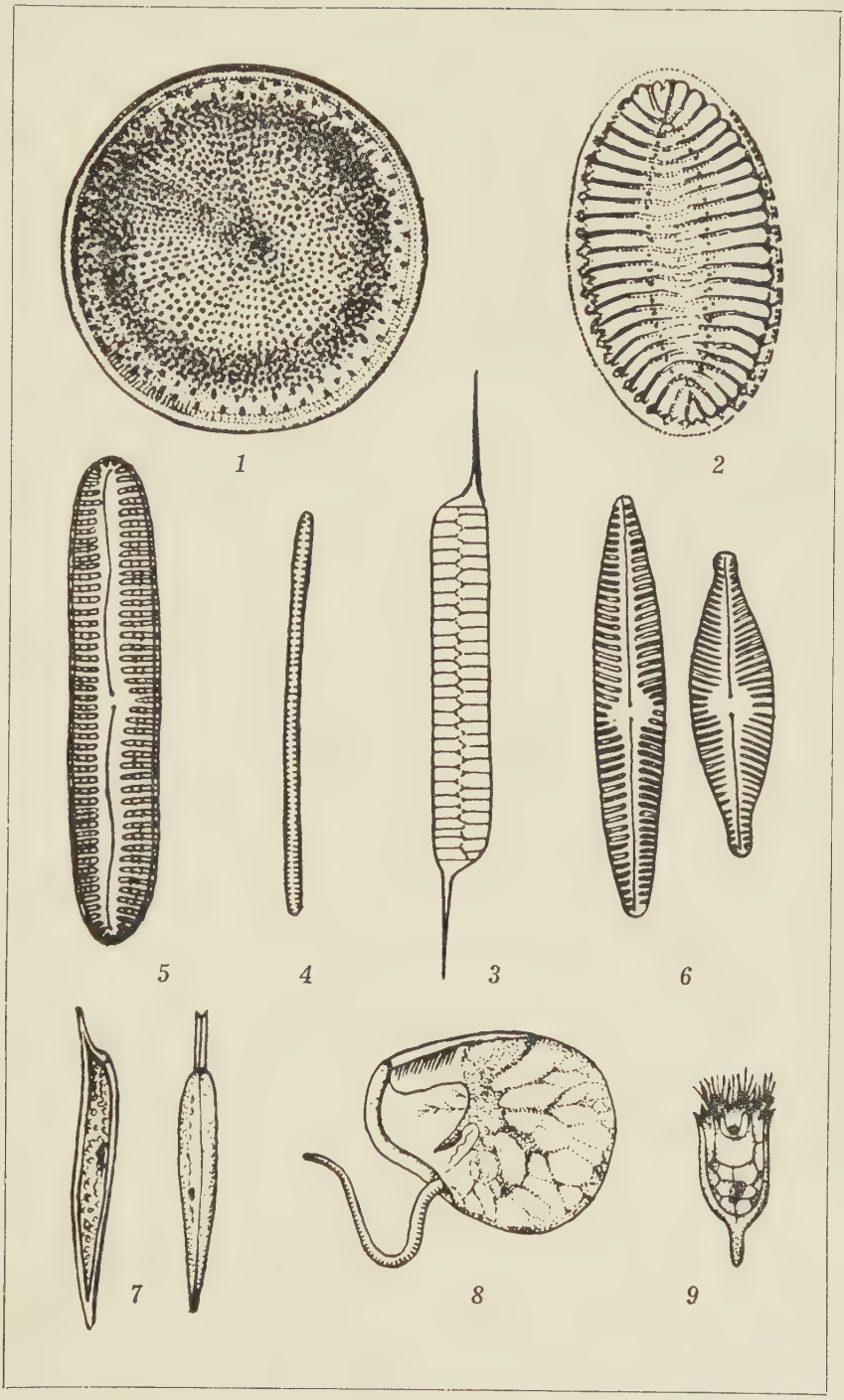

PLATE 1.

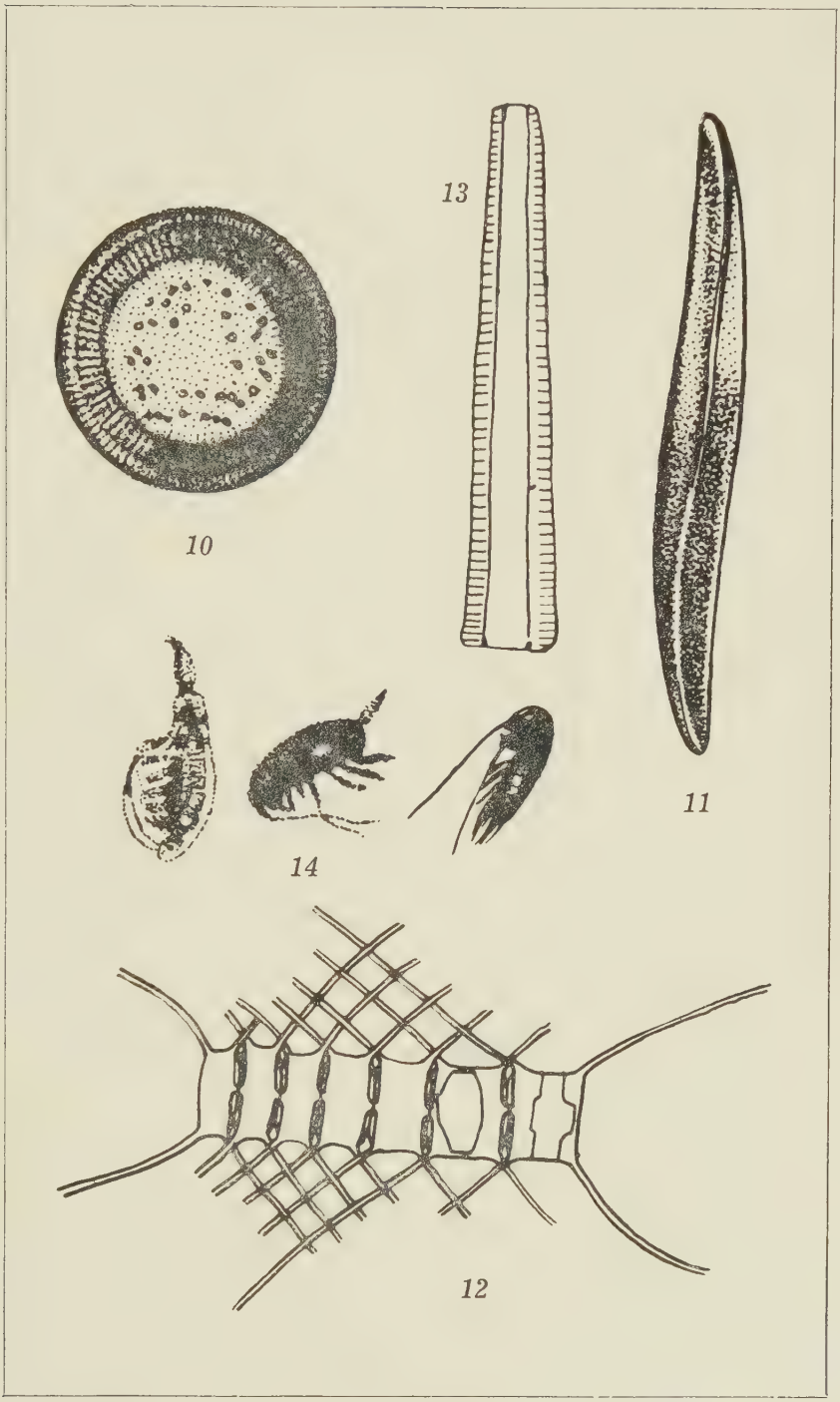

PLATE 2.

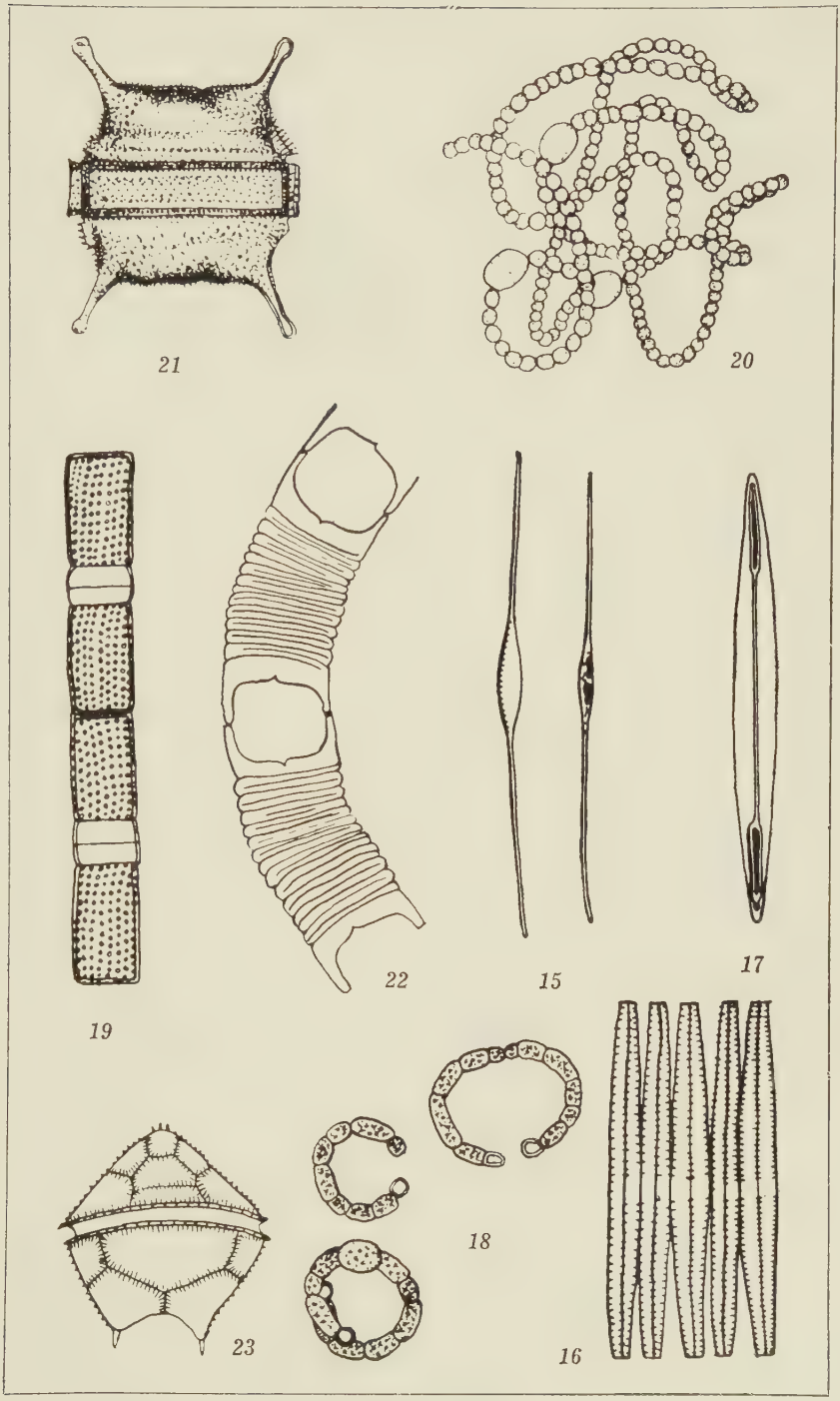

PLATE 3.

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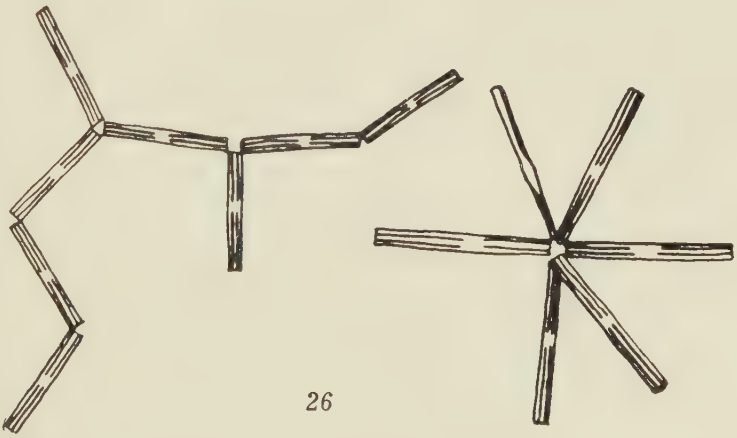

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PLATE 4.

JAPANESE PSYCHODIDÆ, IV

DESCRIPTIONS AND REVISION OF PSYCHODA SPECIES *

By Masaaki Tokunaga

Entomological Laboratory, Saikyo University, Kyoto, Japan

SIXTY-NINE TEXT FIGURES

Ten species of the genus *Psychoda* have been previously reported from Japan by Mrs. Etsuko Murachi Komyo and myself, mainly in the Philippine Journal of Science.[1] Subsequently, I had a chance to examine many other specimens collected from various parts of Japan and neighboring countries, which yielded thirteen additional species, of which seven are new to science and six new records. The present paper deals with the descritions of these additional species, together with corrections of published descriptions of known Japanese species and supplementary notes to our previous publications.

Of the thirteen additional species, *Psychoda nigriventris*, like *Psychoda fungicola* is an important pest of Japanese pine mushroom.

Acknowledgments.—I would like to take this opportunity to thank Dr. Teiso Esaki, professor of Kyushu University, who has kindly sent me valuable literature and important insect specimens. I am also indebted to Messrs, M. Kyioku and A. Nobuchi for their kindness in breeding my two species of injurious moth flies on Japanese pine mushroom. I am further indebted to a number of other entomologists, American and Japanese, who kindly collected many valuable specimens from various parts of Japan and neighboring territories They are Mrs. E. Murachi K. and Messrs. P. Arnaud, G. W. Byers, N. Fukuhara, Y. Hasegawa, I. Hattori, S. Ito, M. Kibe, M. Miyatake, S. Murakami, M. Sasakawa, S. Shogaki, and T. Yano. Thanks are also extended to Miss T. Ito who prepared the figures.

* Contribution from Entomological Laboratory, Saikyo University, Kyoto, No. 51.

[1] Philip. Jour. Sci. 83 (1954) 307–317, 401–417; 84 (1955) 205–228.

Key to the species of Japanese Psychoda

MALES

1. Antennæ 14-segmented ..... 2.
   Antennæ 15- or 16-segmented ..... 4.
2. Antennæ with cylindrical neck parts present on segment 3 to 11; antennal ascoid developed on segments 3 to 12. Three distal segments of antennæ all distinctly separated from each other by sutures or joints. Hypopygium with cerci slightly swollen absally and slender; styles slender, longer than coxites, without special long setæ or scales even on basal part ..... *P. miyatakei* sp. nov.
   Antennæ with cylindrical neck parts present on segments 3 to 12 antennal ascoids developed on segments 3 to 13 ..... 3.
3. Antennæ with ascoids 4-branched, ultimate segment distinctly separated from preceding by joint. Wings with R_{1+2} a little longer than M_{1+2} (35:30). Hypopygium with styles rather thickened basally, tapered apically and rather stout (female unknown). *P. savaiiensis* Edwards.
   Antennæ with ascoids 3-branched, ultimate segment united with preceding and without suture or joint between them. Wings with R_{2+3} far longer than M_{1+2}. Styles of hypopygium each with a single long seta at middle and two rather long setæ on apical part ..... *P. severini* Tonnoir.
4. Antennæ 15-segmented ..... 5.
   Antennæ 16-segmented ..... 9.
5. Wings with radial and median forks incomplete, R_3 and M_2 basally quite atrophied. Style of hypopygium thickened on basal two-thirds, suddenly narrowed on apical one-third and with four long tapelike setæ before apex ..... *P. setigera* Tonnoir.
   Wings with radial and median forks complete R_3 and M_2 basally connected with R_{2+3} and M_{1+2} respectively, although their bases somewhat obscure ..... 6.
6. Wings with dark or brownish spots or clouds on some veins or at ends of some longitudinal veins ..... 7.
   Wings without colored marking on veins or along margins ..... 8.
7. Wings with about ten dark spots on veins. Ultimate two segments of antenna equal in size and shape. Style of hypopygium with a basal very long seta which is longer than style ..... *P. erminea* Eaton.
   Wings with brown or dark spots or clouds at ends of longitudinal veins along margin, although these sometimes obscure and only distal ends of veins colored. Ultimate segment of antenna smaller than penultimate. Style of hypopygium without special long setæ. *P. alternata* Say.
8. Penultimate segment of antenna at least as large as ultimate and with several verticils. Hypopygium with cerci not swollen basally; styles far shorter than unusually long coxites ..... *P. phalænoides* Linnæus.
   Penultimate segment of antenna far smaller than ultimate and without verticils. Hypopygium with cerci slightly swollen basally; styles as long as coxites ..... *P. albipennis* Zetterstedt.
9. Wings with radial and median forks quite incomplete, bases of R_3 and M_2 completely atrophied. Some of distal four antennal segments,

usually thirteenth to fifteenth, united with each other. Styles of hypopygium each with a large basal saclike expansion which extends backwards from articulation to coxite.

P. malleola Tokumaga et Etsuko.

Wings with radial and median forks complete, R_3 and M_2 connected with R_{2+3} and M_{1+2} respectively, although sometimes bases of R_3 and M_2 somewhat obscure ..... 10.

10. Hypopygium with cerci rather short and as long as ninth tergite .... 11.
Hypopygium with cerci rather long and far longer than ninth tergite ..... 15.

11. Cercus of hypopygium with two or three apical retinacula.

P. esakii sp. nov.

Cercus of hypopygium with only one retinaculum ..... 12.

12. Style of hypopygium basally swollen and scaly on basal part ..... 13.
Style of hypopygium not basally swollen and without scales ..... 14.

13. Wings with small scales at bases. Paramere of ædeagus bifurcated distally ..... *P. bifurcata* sp. nov.
Wings without scales. Paramere of ædeagus simple and not forked (female unknown) ..... *P. shikokuensis* sp. nov.

14. Style of hypopygium much longer than coxite, clawlike and with a rather long seta before middle, which is far shorter than style.

P. fungicola Tokunaga.

Style of hypopygium much shorter than coxite, beaklike and with a very long seta at middle, which is far longer than style.

P. longiseta Tokunaga et Etsuko.

15. Style of hypopygium with a very long tapelike seta at base ..... 16.
Style of hypopygium without special long setæ ..... 17.

16. Ædeagus sharply pointed and strongly curved dorsad.

P. hamatifera sp. nov.

Ædeagus clavated, round at tip and almost straight.

P. trilobata sp. nov.

17. Ninth sternite subsquare; ædeagus almost straight and clavated; paramere curved twice on apical half ..... *P. nigriventris* sp. nov.
Ninth sternite subtriangular; ædeagus compressed and curved dorsad on apical part; paramere arcuated ..... 18.

18. Usually fourteenth and fifteenth antennal segments united; style of hypopygium without or with a compact group of four or five minute setæ at base ..... *P. motoharui* Tokunaga et Etsuko.
Usually distal four antennal segments all separated from each other by sutures or joints between them; style of hypopygium with a compact group of seven or eight minute setæ at base.

P. itoco Tokunaga et Etsuko.

FEMALES[2]

1. Antennæ 14-segmented ..... 2.
Antennæ 15- or 16-segmented ..... 3.

[2] Three undetermined Japanese species, Jp-Nos. 2, 3 and 4, are omitted from the key, because the apical antennal segments of all specimens of these three species, are broken off.

2. Antennal cylindrical neck parts present on segments 5 to 11; antennal ascoids developed on segments 3 to 12 ..... *P. miyatakei* sp. nov.
Antennal cylindrical neck parts present on segments 3 to 12; antennal ascoids developed on segments 3 to 13 ..... *P. severini* Tonnoir.

3. Antennæ 15-segmented ..... 4.
Antennæ 16-segmented ..... 9.

4. Wings with radial and median forks incomplete, R_3 and M_2 disconnected basally with R_{2+3} and M_{1+2} respectively ..... 5.
Wings with radial and median forks complete, R_3 and M_2 connected basally with R_{2+3} and M_{1+2} respectively, although their bases somewhat obscure ..... 6.

5. Antennæ with distal three segments separated from each other by sutures between them. Subgenital plate shield-shaped (male unknown) ..... *P.* Jp–No. 1.
Antennæ with distal three segments united with each other, sutures between them being absent. Subgenital plate broadly transverse. *P. setigera* Tonnoir.

6. Wings with brownish or dark spots or clouds on some veins or at ends of some veins ..... 7.
Wings without colored marking on veins or along margins ..... 8.

7. Wing with about ten dark spots on veins. Ultimate antennal segment equal to penultimate in size and shape. Subgenital plate broadly transverse, with caudal lobes small ..... *P. erminea* Eaton.
Wing with colored marking along wing margin at ends of veins, sometimes these spots obscure and only distal ends of veins colored. Subgenital plate V-shaped and with caudal lobes large and divergent caudal arising from small common base ..... *P. alternata* Say.

8. Fourteenth segment of antenna at least as large as ultimate, with pebescence and several verticils. Subgenital plate with caudal lobes as long as wide and round at apices; inner rod somewhat clavated or round at tip and very short ..... *P. phalaenoides* Linnæus.
Fourteenth segment of antenna far smaller than ultimate, without verticils. Subgenital plate with caudal lobes very short and round apically; inner rod conical ..... *P. albipennis* Zetterstedt.

9. Wings with radial and median forks quite incomplete, bases of R_3 and M_2 completely atrophied..... *P. malleola* Tokunaga et Etsuko.
Wings with radial and median forks complete, R_3 and M_2 connected with R_{2+3} and M_{1+2} respectively, although sometimes bases of R_3 and M_2 obscure ..... 10.

10. Subgenital plate with a large median projection, which is longer than wide and consists of basally fused caudal lobes ..... 11.
Subgenital plate much wider than long and without elongated median projection ..... 13.

11. Subgenital plate without basal paired lateral lobes at sides of median projection ..... *P. itoco* Tokunaga et Etsuko.
Subgenital plate with basal paired lateral lobes at sides of median projection ..... 12.

12. Subgenital plate with median projection distinctly narrowed basally and its two lateral sides much divergent caudad *P. bifurcata* sp. nov.
Subgenital plate with median projection not or very slightly narrowed basally and its two lateral sides almost parallel *P. trilobata* sp nov.

13. Subgenital plate with caudal lobes distinctly longer than wide and very much divergent caudad; inner rod very small and about twice as long as wide ..... *P. motoharui* Tokunaga et Etsuko.
Subgenital plate with caudal lobes shorter than wide and not divergent caudad; inner rod long and at least thrice as long as wide ..... 14.

14. Subgenital plate with very deep caudal incision, which is deeper than half of length of subgenital plate ..... 15.
Subgential plate with shallow caudal incision, which is at most semicircular ..... 17.

15. Caudal incision of subgenital plate U-shaped and reaching to basal edge of sternite ..... *P. esakii* sp. nov.
Caudal incision of subgenital plate V-shaped and not reaching to basal edge of sternite ..... 16.

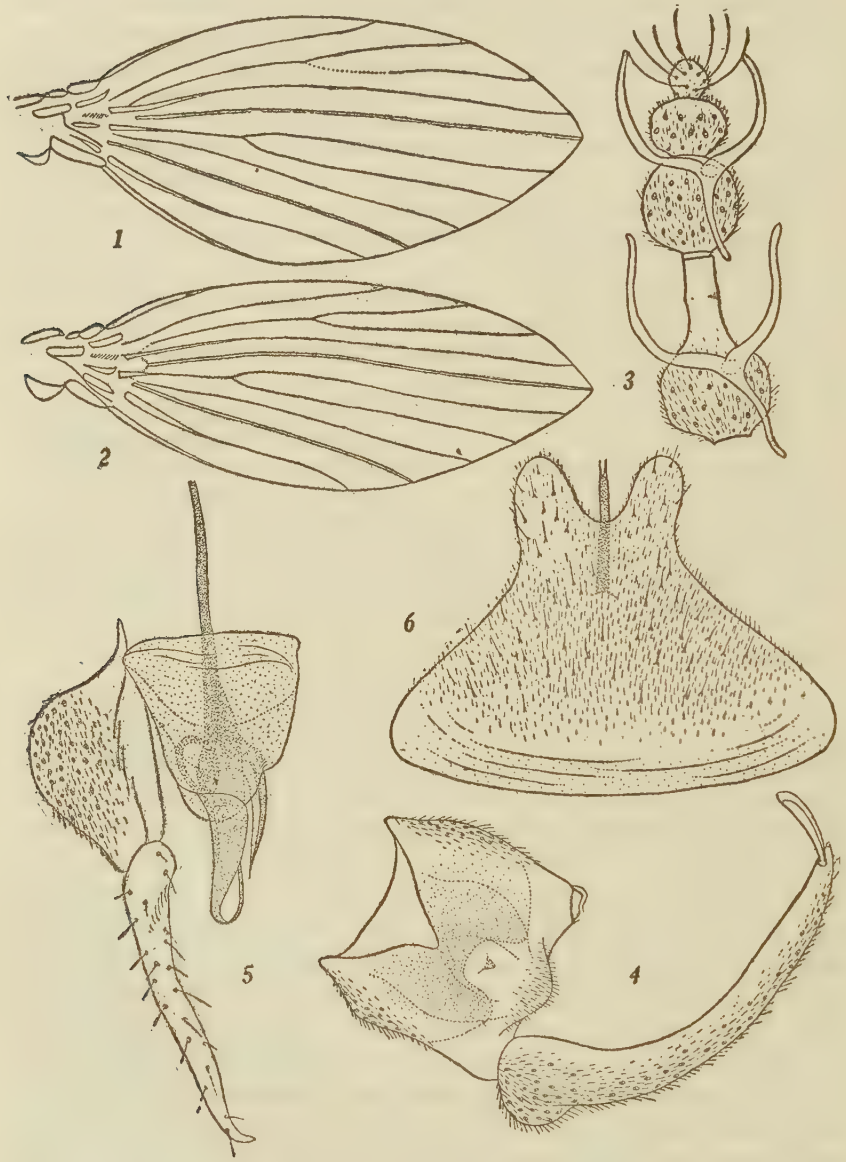
16. Ultimate antennal segment equally spherical to preceding two segments ..... *P. longiseta* Tokunaga et Etsuko.
Ultimate antennal segment oval differing from somewhat discoidal preceding two segments ..... *P. hamatifera* sp. nov.

17. Thirteenth and fourteenth antennal segments united with each other and each with a minute sensory cone ..... *P. fungicola* Tokunaga.
Distal four antennal segments all separated from each other by sutures or joints between them ..... *P. nigriventris* sp. nov.

PSYCHODA MIYATAKEI sp. nov.

A pale brownish medium-sized species. Antennæ 14-segmented, with ascoids all Y-shaped and present on segments 3 to 12, neck parts on segments 3 to 11; twelfth segment spherical, with many verticils and a pair of Y-shaped verticils and without neck part; thirteenth smaller than preceding, somewhat discoidal, with many verticils and without ascoids, ultimate segment as large as preceding or smaller, short-oval and with several verticils. Wings with radial and median forks, but in male base of R_3 somewhat broadly obscure, R_1 ending above or just beyond tip of Cu_1, radial fork far beyond median fork. Male hypopygium with cerci slender, somewhat swollen basally and with single retinacula at tips; styles slender, far longer than coxites and without scales; accessory piece of ædeagus sharply pointed and ending a little before tip of ædeagus. Female subgenital plate very broad basally and distinctly narrowed caudad and ending into two caudal lobes which are almost parallel, a little longer than basal width, round apically and separated by a V-shaped median caudal incision from each other; inner rod slender, arising

from a little before the narrowest part of the plate and extending caudad almost as far as caudal lobes.



***Psychoda miyatakei* sp. nov.**

FIG. 1. Male wing; 2, female wing; 3, apical segments of male antenna; 4, ventral part of male hypopygium; 5, dorsal part of male hypopygium; 6, female subgenital plate.

Male.—Body length, about 1.03 mm. Wings, about 1.47 by 0.65 mm. General coloration slightly brownish gray.

Head with eyes separated above as wide as 0.7 facet from each other, without eye-bridge. Maxillary palpi with four segments in proportion of 20:21:22:30. Antennæ (Fig. 3) 14-segmented, with neck parts on segments 3 to 11, ascoides all Y-shaped and present on segments 3 to 12, twelfth segment spherical, thirteenth somewhat discoidal, with many verticils, far smaller than preceding and distinctly separated from preceding by a joint, fourteenth smaller than preceding, well separated, short-oval and with several or a dozen of verticils; relative length of basal four and apical eight segments about 22:15:27:26 and 29:27:24:20:18:11:6:4 respectively.

Legs with segments, except for coxæ and trochanters, in proportion of 82:85:32:14:12:12:14 in fore, 84:117:40:16:13:12:14 in middle and 101:132:43:16:13:12:14 in hind leg. Wings (Fig. 1) very pale brown, R_1 ending at level of tip of Cu_1, with radial and median forks, the former far beyond the latter and base of R_3 broadly obscure, relative lengths of R_{2+3} R_2, R_3, M_{1+2} and M_2 about 38:31:46:29:60.

Hypopygium (Figs. 4 and 5) with ninth tergite subsquare (40 × 44); cerci slender, longer than twice of tergite (90:40), somewhat swollen ventrad at bases, gradually tapered and with single slender retinacula at tips; ninth sternite rather small, longer than wide, round on caudal margin and entirely bare; coxites rather well developed (30 × 16), laterally swollen and scaly; styles far longer than coxites (42:30), slender, pointed apically, without special long setæ and scales; ædeagus almost straight, far longer than styles (55:42), with accessory piece sharply pointed, almost straight, closely along ædeagus and ending far before round tip of ædeagus.

Female.—Body, about 1.7 mm long. Wings, about 2 by 0.78 mm and relatively narrower than in male. General structure and coloration closely similar to those of female with usual sexual differences.

Head with maxillary palpal segments in proportion of 25:27:-23:36. Antennæ with last segments oval and subequal to preceding discoidal segments, relative lengths of basal four and distal eight segments about 20:17:27:27 and 27:27:25:24:21:11:6:.5:7 respectively.

Legs with segments, except for basal two, in proportion of 100:108:42:22:17:14:16 in fore, 118:148:54:23:18:14:17 in

middle and 132:184:53:25:20:16:18 in hind leg. Wings (Fig. 2) with R_1 ending just beyond tip of Cu_1, radial and median forks complete, the former far beyond the latter and slightly before tip of Cu_1, relative lengths of R_{2+3} R_2, R_3, M_{1+2} and M_2 about 52:42:61:36:84.

Subgenital plate (Fig. 6) setigerous, broad on basal half, narrowed caudad, ending into paired short caudal lobes which are parallel to each other, round at tips and separated from each other by a median V-shaped incision; inner rod slender, extending into caudal incision; ovipositor rather short, but far longer than subgenital plate (55:42), basal half brown and apical half yellow.

Holotype.—Male; Matsuyama, Shikoku; November 14, 1948 (*M. Miyatake*).

Allotype.—Female at same place; October 31, 1951 (*M. Tokunaga*).

Locality.—Shikoku, Japan.

This is closely allied to *Psychoda brevicornis* Tonnoir in the structures of the antennæ and of the male hypopygium, but in the allied species the radial and median forks are quite incomplete highly differing from the present species.

PSYCHODA SAVAIIENSIS Edwards.

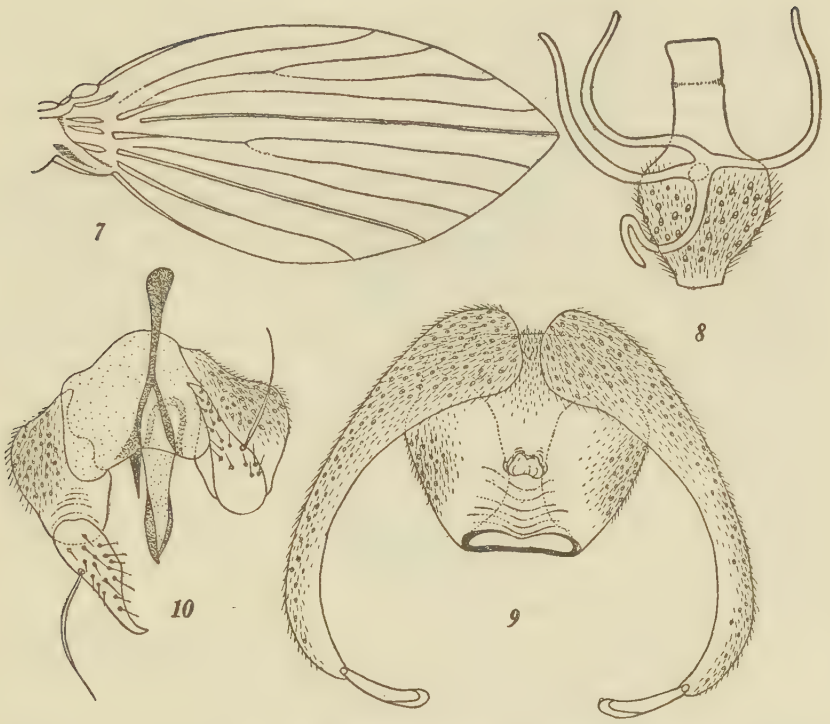
P. savaiiensis EDWARDS, Insects of Samoa 6 (1928) 74.

A medium-sized pale gray species, distributed on islands of Pacific Ocean. Antennæ with ascoids four-branched as in the European *Psychoda pusilla* Tonnoir. Wings with R_1 ending beyond tip of Cu_1, with radial and median forks, but R_3 and M_2 somewhat obscure at bases. Male hypopygium with cerci long, slender, with single retinacula at tips and basally not strongly swollen; styles as long as coxites, somewhat conical, sharply pointed and with single long setæ just before middle; ædeagus almost straight and pointed, its accessory piece also pointed apically.

Male.—Body, length about 1.59 mm. Wings, about 1.54 by 0.73 mm. Coloration pale brownish gray in dry specimen and pale brown in mounted specimen.

Head with eyes separated above as wide as a facet from each other, with highly reduced eye-bridge. Maxillary palpi with four segments about 24:25:28:35 in proportional length. Antennæ (Fig. 8) with ascoids all four-branched, three extending forewards and one backwards; distal segments broken off.

Legs with segments except for coxæ and trochanters, in relative length of 104:106:39:18:16:15:16 in fore, 114:143:50:



***Psychoda savaiiensis* Edwards (Male)**

FIG. 7. Wing; 8, a flagellar segment; 9, ventral part of hypopygium; 10, dorsal part of hypopygium.

19:17:14:16 in middle and 130:165:50:18:17:14:15 in hind leg. Wings (Fig. 7) rather broad, R_1 ending above tip of Cu_1, two forks present, but bases of R_3 and M_2 somewhat obscure, radial fork slightly beyond median fork, relative lengths of R_{2+3}, R_2 and R_3 about 35:35.5:46:5 and those of M_{1+2} and M_2 about 30:60.

Hypopygium (Figs. 9 and 10) with ninth tergite about as long as width (57.5:54.5), cerci long, about twice as long as tergite (102:57.5) and each with a rather large retinaculum which is about 0.2 as long as cerci; ninth sternite rather small, uniformly membranous and quite bare; coxites stout (27.5×7.5), about half as long as tergite and scaly on lateral sides; styles almost as long as coxites, with basal half rather broad and apical half tapered and pointed, a long seta present before middle of each style; ædeagus almost straight, pointed apically, its entire length slightly longer than tergite; accessory piece extending along ædeagus, pointed apically, straight or somewhat curved and ending far before tip of ædeagus.

Female.—Unknown.

Specimens.—Two males; Naha vicinity, Okinawa, Ryukyu Islands; February 5 to 6, 1955 (*P. Arnaud,* by light trap).

Distribution.—Savaii Island, Samoa Islands and Okinawa Island, Ryukyu Islands.

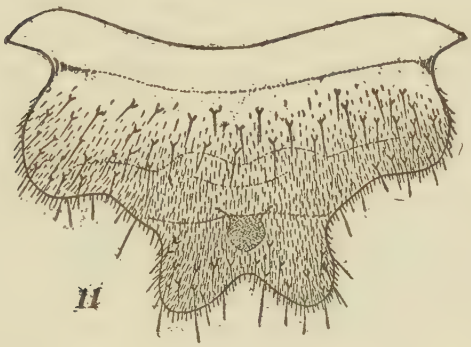
The structure of the male hypopygium is very closely identical with Edwards' description, only except for the basal swellings of the cerci. The present specimens are not provided with complete antennæ, but the holotype is provided with 14-segmented antennæ, and thirteenth segment bears a short but distinct neck part and a pair of four-branched ascoids, ultimate segment is far smaller than preceding, less pointed apically, somewhat oval and with many verticils, *Psychoda pusilla* Tonnoir, which is only one species in the North Hemisphere provided with four-branched antennal ascoids, is distinctly different from the present species in the structure of the male hppopygium in the following point: the styles without special long isolated setæ and basally scaly distinctly.

PSYCHODA SEVERINI Tonnoir.

P. severini TONNOIR, Ann. Soc. Ent. Belg. 62 (1922) 78–81; DEL ROSARIO, Philip. Jour. Sci. 59 (1936) 102–105; TOKUNAGA and KOMYO, Philip. Jour. Sci. 83 (1954) 308–309.

Well known species, distributed very widely in Europe, North America, Australia and Japan. Antennæ only 14-segmented. with ascoids all well developed, Y-shaped, present on segments 3 to 13, neck parts present on segments 3 to 12, verticils all very finely plumous on distal parts; thirteenth and fourteenth not separated by suture but only constricted narrowly at the position of the suture; the former segment as large as basal node of preceding one, with a cone and many verticils; ultimate far smaller than penultimate, oval and with several verticils. Wings with radial and median forks complete. Female subgenital plate (Fig. 11) far wider than long (72 to 79:59), setigerous, with shoulder parts round and somewhat produced, caudal lobes very short, round at tips and separated by shallow wide V-shaped caudomedian incision from each other; inner rod very short and stout; spermathecæ (Fig. 12) without reticulation on surface and with large membranous expansions; ovipositor normal. Female about 1.2 to 2.3 mm long and wings about 1.7 to 2.4 mm long. Male sex has been found as yet in Japan.

Specimens.—A female; Inu-u-in-Mura, Ehime Prefecture; April 13, 1949 (*M. Miyatake*). A female; Unazuki, Toyama



***Psychoda severini* Tonnoir (Female)**

FIG. 11. Subgenital plate; 12, spermathecæ

Prefecture; June 23, 1954 (*M. Tokunaga* and *E. Murachi*). Three females; Tokyo; November 27 to December 26, 1951 (*N. Fukuhara*). Six females; June 1 to 15, 1951; Midoro-ike, Kyoto (*S. Shogaki*, by light trap). A female; Mt. Hiei, Kyoto; April 20, 1955 (*M. Sasakawa*). Two females; Nukabira, Hokkaido; June 13, 1954 (*M. Sasakawa*). Three females at Sockchori, Korea, on June 2, a female at Osan on June 16 and a female at Seoul, Korea, on May 20, 1954 (*G. W. Byers*, by light trap).

Distribution.—Europe, North America, Australia, Korea, and Japan (Hokkaido, Honshu, and Shikoku).

The specimens examined all belong to the subspecies *parthenogenetica* Tonnoir, the distal two segments being not separated by a suture.

PSYCHODA SETIGERA Tonnoir.

P. setigera TONNOIR, Ann. Ent. Soc. Belg. 62 (1922) 84–85; FREEMAN, Handbook for identification of British insects, Dipt. 2 (1950) 93, 95; TOKUNAGA and KOMYO, Philip. Jour. Sci. 83 (1954) 309–310; TOKUNAGA and KOMYO, Philip. Jour. Sci. 84 (1955) 227–228; JUNG, Deuts. Ent. Zeits. 3 (1956) 201, 203.

A rather small or medium-sized brownish gray species. Antennæ 15-segmented, with ascoids all Y-shaped and developed

on segments 3 to 13, distal three segments somewhat different sexually, in female not separated while in male separated by somewhat obscure sutures. Wings with R_1 ending just or slightly beyond tip of Cu_1, both forks incomplete or rarely mediam fork reduced but present. Male hypopygium with cerci far longer than cerci and with single slender apical retinaculum; styles rather thick on basal two-thirds and suddenly narrowed apically, with slender scales on basal part and very long tapelike setæ beyond middle. Female subgenital plate closely similar to that of *P. longiseta* Tokunaga et Etsuko.

Male.—Body, about 1.24 mm long. Wings, about 0.91 by 0.44 mm. General coloration brownish gray in dry state.

Head with eyes separated above as wide as one facet. Antennæ 15-segmented, with ascoids all Y-shaped and present on segments 3 to 13, neck parts present on segments 3 to 12, but thirteenth with short but distinct neck part, subspherical and as large as basal node of preceding segment; fourteenth discoidal, far smaller than preceding, distinctly separated by a joint and with many verticils; ultimate segment not distinctly separated, very small, round and with a few verticils; relative lengths of distal eight segments about 20:20:19:18:15:13:5:3.

Wings broad, about twice as long as wide, with R_1 ending slightly beyond tip of Cu_1, radial and median forks incomplete, R_3 broadly and M_2 very narrowly atrophied at bases; relative lengths of R_{2+3} and R_2 taken together and R_3 about 45:19, those M_{1+2} and M_1 taken together and M_2 about 62:33.

Hypopygium with ninth tergite somewhat square, slightly longer than wide (40:38); cerci arcuated, about 1.5 times as long as tergite, basally swollen and each with a long and slender apical retinaculum which is about one-third as long as cercus (22:60); ninth sternite quite bare; coxites rather slender and subcylindrical; styles longer than coxites (36:32), basal two-thirds rather thickened, suddenly narrowed and slender on apical one-third, setigerous and scaly on basal part, with scattered minute setæ on apical part and several long and tapelike setæ on apical part of basal thickened part which are almost as long as coxites (30:32).

Female.—Body, about 1.5 mm long. Wings, about 1.7 by 0.7 mm. Generally as in male but antennal segmentation of distal part obscure.

Head with maxillary palpal segments in proportion of 23:21:23:31.5. Antennæ with distal three segments not separated by

sutures but all fused with each other; relative lengths of distal eight segments about 24.5:24.5:23:23:20:10.5:8:5. Wings rather slender, with R_1 ending just beyond tip of Cu_1, radial fork always incomplete, but median fork sometimes present although base of M_2 somewhat obscure; relative lengths of R_{2+3} and R_2 taken together and R_3 about 75 to 78:30 to 44 and those of M_{1+2}, M_1 and M_2 about 31:72:80.5. Subgenital plate very closely similar to that of *Psychoda longiseta* Tokunaga et Etsuko, far broader than long (60:27), with caudal lobes triangular and widely separated by a V-shaped deep incision from each other; inner rod cylindrical, rather long, longer than caudal lobes (12:10) and extending into caudal incision.

Distribution.—Europe and Japan (Honsyu and Shikoku).

This species is highly specific in possession of characteristic distal segments of antennæ, wing venation, styles of male hypopygium and female subgenital plate.

PSYCHODA ALBIPENNIS Zetterstedt.

P. albipennis TONNOIR, Ann. Soc. Ent. Belg. 12 (1922) 81–83; EDWARDS, Insects of Samoa 6 (1928) 75; SATCHELL, Paras. 38 (1947) 59–61; FREEMAN, Handbooks for the identification of British insects. Dipt., Nematocera 9 (1950) 91–96; JUNG, Deut. Ent. Zeitsch. 3 (1956) 188.

A rather large pale brownish species. Antennæ 15-segmented, but penultimate highly reduced into a minute intersegmental hyaline swelling; ascoids all Y-shaped and present on segments 3 to 13; ultimate segment rather large, oval and with verticils. Wings with R_1 ending above or slightly beyond tip of Cu_1, both forks present, but bases of R_3 and M_2 somewhat obscure and radial fork far beyond median fork. Subgenital plate of female far broader than length and with caudal lobes very short and round apically.

Female.—Body, length 1.85 (1.76 to 1.95) mm. Wings, about 1.61 (1.43 to 1.69) by 0.7 (0.64 to 0.74) mm. General coloration pale brownish gray in dry state and pale brown in mounted state.

Head with eyes separated above as wide as one and half facets from each other, without eye-bridge. Maxillary palpi with four segments in proportion of 24:25.3:26.3:36. Antennæ (Fig. 14) 15-segmented, but penultimate segment highly reduced into a minute hyaline intersegmental swelling, with ascoids all well developed, Y-shaped and present on segments 3 to 13, neck parts rather long, fully or almost as long as basal nodes and present on segments 3 to 12; thirteenth segment subspherical,

almost as large as node of preceding segment and with a minute cone on apical part; fourteenth highly reduced into a minute hyaline swelling, with a minute cone, but without verticils and pubescence; ultimate segment rather large, oval, pubescent and with many verticils; relative lengths of basal five and apical nine segments about 21.3:16:22.7:22.8:24 and 23:21.7:20.7:20.3:19.7:18.3:11:3:7.3.

Legs with segments, except for coxæ and trochanters, in proportion of 103:97:36:17:15:14:18 in fore, 113:133:48:20:17:15:19 in middle and 132.8:166.8:48.5:19.8:17:15.3:18 in hind leg. Wings (Fig. 13) very pale brownish hyaline; venation: R_1 ending above or slightly beyond tip of Cu_1, radial and median forks present, but extreme bases of R_3 and M_2 somewhat obscure, radial far beyond median fork, relative lengths of R_{2+3}, R_2 and R_3 about 38.8:36.8:53.8 and those of M_{1+2}, M_1 and M_2 about 31:74.8:67.5.

Subgenital plate (Fig. 15) far broader than length (43:26.5), with caudal median incision very shallow and wide, then two lateral lobes very short and round at apices, inner rod conical, rather long, arising slightly before caudal margin and extending into caudal incision; sternite broadly and completely fused with subgenital plate; ovipositor long and about 2.2 times as long as subgenital plate.

Specimens.—Two females; Naha vicinity, Okinawa, Ryukyu Islands; January 23, 1955 (*P. Arnaud,* by light trap). Two females at same place; February 12, 1955 (*Arnaud,* by light trap).

Distribution.—Europe, Fiji Islands, and Ryukyu Islands.

The Japanese specimens are slightly different from the description of Tonnoir in the shape of the inner rod of the female subgenital plate; in the European specimens the rod is short being only twice as long as basal width, while in the Japanese females the rod is long being about four times as long as basal width. According to Tonnoir, the male hypopygium is provided with slender cerci which are not suddenly expanded basally and fully twice as long as the ninth tergite; the coxites and styles are rather slender, subequal in length and the latter are slender, tapered, sharply pointed and not scaly or setigerous basally.

PSYCHODA ALTERNATA Say.

P. alternata Say, Long's Exp. St. Peter's River, App. 1824 (1824) 358.

P. sexpunctata Curtis, Brit. Ent. 16 (1839) 745; Eaton, Ent. Month. Mag. 9 (1898) 120.

P. schizura Kincaid, Ent. News 10 (1899) 32; Kincaid, Ent. News 12 (1901) 193.

P. floridica HASEMAN, Trans. Amer. Ent. Soc. 33 (1907) 316.
P. nocturnala HASEMAN, Trans. Amer. Ent. Soc. 33 (1907) 319.
P. bengalensis BRUNETTI, Rec. Ind. Mus. 11 (1908) 370.
P. albimaculata WELCH, Ann. Ent. Soc. Amer. 5 (1912) 411; TONNOIR, Ann. Ent. Soc. Belg. 62 (1922) 72–74.
P. dakotensis DYAR, Insec. Inscit. Menst. 14 (1926) 107–110; EDWARDS, Insects of Samoa, Part 6, Fas. 2 (1928) 75; DEL ROSARIO, Philip. Jour. Sci. 59 (1936) 93–95; DEL ROSARIO, Philip. Jour. Sci. 59 (1936) 559; SATCHELL, Parasitology 38 (1947) 60–62; FREEMAN, Handbook for identification of Britist insects. Dipt. 2 (1950) 93, 96; TOKUNAGA, Mag. Med. Zool. Japan 4 (1953) 101–107; SATCHELL, Austr. Jour. Zool. 1 (1953) 361; TOKUNAGA and KOMYO, Philip. Jour. Sci. 83 (1954) 309; JUNG, Deut. Ent. Zeits. 3 (1956) 188.

A medium-sized dark gray and well known species, very widely distributed on the world and very abundant locally. Antennæ 15-segmented, with ascoids Y-shaped or triangular, small and present on segments 3 to 13, distal three segments not separated, but fused: fourteenth far smaller, round, broadly fused with preceding, with about ten verticils and without sensory cone; ultimate very small, usually oval and very rarely separated by an obscure suture and with a few verticils. Wings with ten dark spots at ends of main veins or several spots alternatively arranged at ends of veins along wing margin and obscure dark clouds on upper surface of wings in dry state. Male hypopygium with cerci about twice as long as ninth tergite (80.43), swollen basally and each with a rather slender small apical retinaculum; ninth sternite subsquare and quite bare; coxites far shorter than ninth tergite (30:43), rather slender and scaly on lateral sides; styles as long as coxites (32:30), pointed apically, not distinctly thickened basally, without scales or special long setæ; ædeagus and paramere subequal in length and almost straight, apodeme a little longer than ædeagus. Female subgenital plate V-shaped, with lobes distinctly separated from sternal thickening by a suture at narrowed common base, part of sternite highly reduced; inner rod not developed.

Specimens.—A female and a male; Ngarbaged, Korror Island, Palau Islands, Micronesia; December 18, 1937 and March 28, 1938 respectively (*S. Murakami*). A female; Mt. Ari, Formosa; December 27, 1934 (*M. Tokunaga*). Three female; Taegu (K–2), Korea; June 2, 1954 and a male and two female; Seoul, Korea; June 5, 1954 (*G. W. Byers,* by light trap). A male; October 2, 1955; Sanbongi, Aomori Prefecture (*M. Tokunaga*). A female; Matsuyama, Ehime Prefecture (*M. Miyatake*). A female; Nishigahara, Tokyo; May 16, 1951 (*I. Hattori*). A male; Matsu-

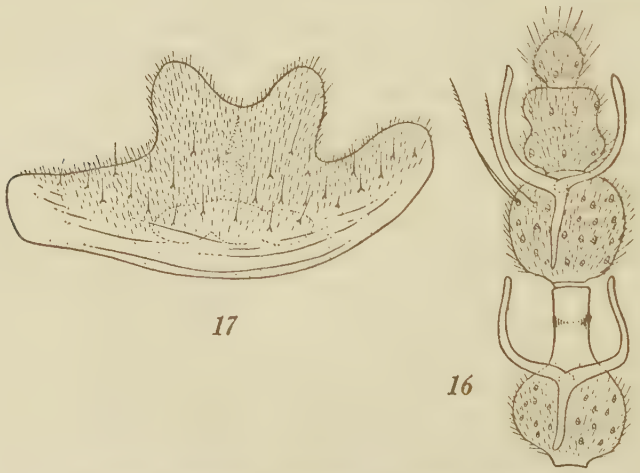
yama, Ehime Prefecture; October 3, 1951 (*M. Tokunaga*). A female and a male; Zyozankei, Hokkaido; June 10, 1954 and a female; Nukabira, Hokkaido; June 13, 1954 (*M. Sasakawa*). A male and a female; Naha, Okinawa; February 12, 1955 (*P. Arnaud,* by light trap). A female; Mt. Hiko, Kyusyu; July 22, 1955 (*T. Esaki*). Five males and four females; Saizyo, Hiroshima Prefecture; June 20 to 26, 1956 (*Y. Kiyoku*).

Distribution.—Europe, North America, Australia, India, Samoa, Philippines, Formosa, Korea, and Japan (Hokkaido, Honsyu, Shikoku, Kyusyu, and Okinawa).

PSYCODA MALLEOLA Tokunaga et Etsuko.

P. malleola TOKUNAGA and KOMYO, Philip. Jour. Sci. 83 (1954) 310–312.

A medium-sized or rather small very pale brownish gray species and rather widely distributed in Japan. Antennæ 16-segmented, with ascoids all Y-shaped and present on segments 3 to 13, neck parts present on segments 3 to 12, thirteenth segment spherical and with many verticils, fourteenth and fifteenth subequal, similarly discoidal, with several verticils and always fused with each other, segmentation between thirteenth and fourteenth usually incomplete as in original description, but sometimes complete as in Figure 16, ultimate segment distinctly separated by a suture from penultimate, somewhat oval and with several verticils. Wings with radial and median forks incomplete, R_3 broadly and M_2 narrowly atrophied at bases, R_1 ending far beyond tip of Cu_1, M_2 about 2 to 2.26 times as long as R_3. Male hypopygium



***Psychoda malleola* Tokunaga et Etsuko (Female).**

FIG. 16. Apical segments of antenna; 17, subgenital plate.

with cerci very long, slightly arcuated, not strongly swollen basally and each with a large retinaculum at tip, styles peculiar in shape, proper part about two-thirds as long as coxite, slightly curved at tip and not pubescent, basal expansion very large, saclike, extended backwards and scaly on distal part. Female subgenital plate (Fig. 17) very small, broadly fused with setigerous tranverse sternite, far shorter than wide, two caudal lobes short, semicircular, widely separated from each other by a broad and shallow caudal median incision and pubescent but without setæ; inner rod rather long, but not extending caudal distinctly beyond subgenital plate; ovipositor normal.

Specimens.—A female; Haruyoshi, Fukuoka Prefecture; June 12, 1943 (S. Ito). A female; Unazuki, Toyama Prefecture; June 22, 1954 (*M. Tokunaga* and *E. Murachi*).

Distribution.—Honsyu and kyusyu, Japan.

A female specimen from Toyama Prefecture is larger, the wings being about 1.69 by 0.78 mm and with antennal segments as in figure.

PSYCHODA ESAKII sp. nov.

A pale brownish gray species. Male somewhat resembling to that of *Psychoda humeralis* Meigen. Antennæ 16-segmented, with all segments well separated; two anterior arms of ascoids of male somewhat swollen basally; thirteenth segment with two ascoids but without neck part; following two subdiscoidal, far smaller than preceding, subequal, with many verticils but without ascoids; ultimate subspherical, as large as preceding and with many verticils. Wings with R_1 ending more or less beyond tip of Cu_1, radial and median forks present but bases of R_3 and M_2 narrowly obscure. Male hypopygium with cerci short, as long as ninth tergite and bearing two or three long retinacula at each tip, styles somewhat swollen and scaly basally, stout, slightly arcuated and each with a pre-apical notch; ædeagus with parameres two, equal, sharply pointed, a little shorter than external part of ædeagus and divergent apically to each other. Female subgenital plate completely subdivided into two lobes, which are somewhat triangular, setigerous and separated from each other by a deep U-shaped caudal incision; inner rod slender, arising from cephalic end of caudal incision and with closely associated two oval lobes.

Male.—Body, about 1.76 mm long. Wings, about 1.95 by 0.81 mm. General coloration pale brownish gray in dry state

and pale brown in mounted state; antennæ and hypopygium resembling those of *Psychoda humeralis* Meigen.

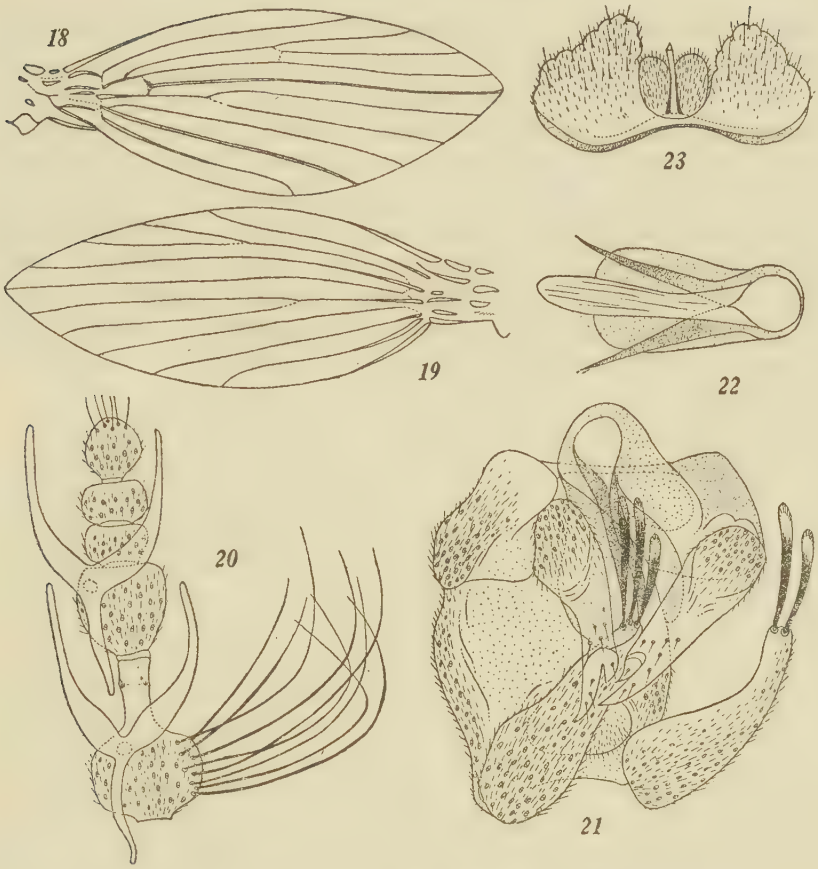
Head with eyes broadly contiguous above with each other, frontal scaly area somewhat trapezoid. Maxillary palpi with four segments in proportion of 22:33:32:49. Antennæ (Fig. 20) 16-segmented, with ascoids all Y-shaped, present on segments 3 to 13 and its two anterior arms somewhat swollen basally, neck part present on segments 3 to 12, distal four segments all distinctly separated by joints; two penultimate segments subdiscoidal, far smaller than thirteenth, subequal and with many verticils; ultimate subspherical or short-oval and with many verticils as in preceding two.

Legs uniformly brown, with segments excepting coxæ and trochanters in relative length of 120:125:62:23:21:17:17 in fore, 122:150:75:25:20:15:18 in middle and 140:184:75:25:21:15:19 in hind leg. Wings (Fig. 18) subrhombic, without distinct scales, R_1 ending far beyond tip of Cu_1 and slightly before tip of M_4, both forks present but bases of R_3 and M_2 narrowly obscure, radial fork far beyond median and slightly before tip of Cu_1, relative lengths of R_{2+3}, R_2 and R_3 about 48:45:58, those of M_{1+2} and M_1 about 39:82.

Abdominal tergites brown, but other parts all pale brown; hypopygium (Fig. 21) with ninth tergite subsquare, very slightly shorter than wide (52:50); cerci as long as tergite and with two or three retinacula which are very long and about half as long as cerci (20 to 28:50) coxites stout, shorter than wide (25:30) and with many scales on lateral sides; styles far longer than coxites and subequal to cerci (49:25:50), somewhat swollen and scaly basally, tapered, arcuated, sharply pointed and each with a small pre-apical notch; ædeagus (Fig. 22) almost straight, clavated and with a large saclike structure on external part; parameres two, sharply pointed, divergent to each other caudal and a little shorter than external part of ædeagus.

Female.—Body length, about 1.63 mm. Wings, about 1.35 by 0.53 mm. General coloration brownish gray in dry state.

Head with eyes separated above as wide as a facet from each other. Maxillary palpal segments in proportion of length about 20:20:21:30. Antennæ with ascoids slender, Y-shaped and not specially swollen at bases of anterior arms, distal six segments broken. Legs all broken. Wings (Fig. 19) with R_1 ending beyond tip of Cu_1, other structure closely as in male, relative lengths of R_{2+3}, R_2 and R_3 about 35:25:34, those of M_{1+2}, M_1 and M_2



***Psychoda esakii* sp. nov.**

FIG. 18. Male wing; 19, female wing; 20, apical segments of male antenna; 21, male hypopygium; 22, ædeagus; 23, female subgenital plate.

about 22:60:53. Subgenital plate (Fig. 23) far broader than length, small, almost completely subdivided into paired subtriangular setigerous lobes by a very deep U-shaped caudal median incision; inner rod slender, cylindrical, longer than half of length of paired lateral lobes (16.27), entirely visible in ventral aspect and with a pair of small oval accessory saclike lobes; ovipositor rather short, but normal in shape and about 2.5 times as long as subgenital plate (66.27).

Holotype.—Male; Mt. Hiko, Kyusyu; July 22, 1955 (*T. Esaki*).

Allotype.—Female; Nagamine, Usa, Kyusyu; August 17, 1946 (*M. kibe*).

Locality.—Kyusyu, Japan.

This species is related to *Psychoda humeralis* Meigen, but in the related species the following points are different from the

present new species: first segment of maxillary palpus very short, about two-thirds as long as second and last segment about as long as fourth antennal segments 14 to 16 all short-oval equally; all ascoids of male antennæ short, those of segments 3 to 12 not extending beyond the segments from which they arise; wings with radial fork situated beyond tip of Cu_1 and relative lengths of wing vein R_{2+3}, R_2, M_{1+2}, and M_1 about 32:20:24:47 cerci of male hypopygium always with two retinacula at each tip; female subgenital plate only slightly concave on caudal margin and not completely subdivided into paired lateral lobes and ovipositor very much reduced and not longer than wide.

PSYCHODA BIFURCATA sp. nov.

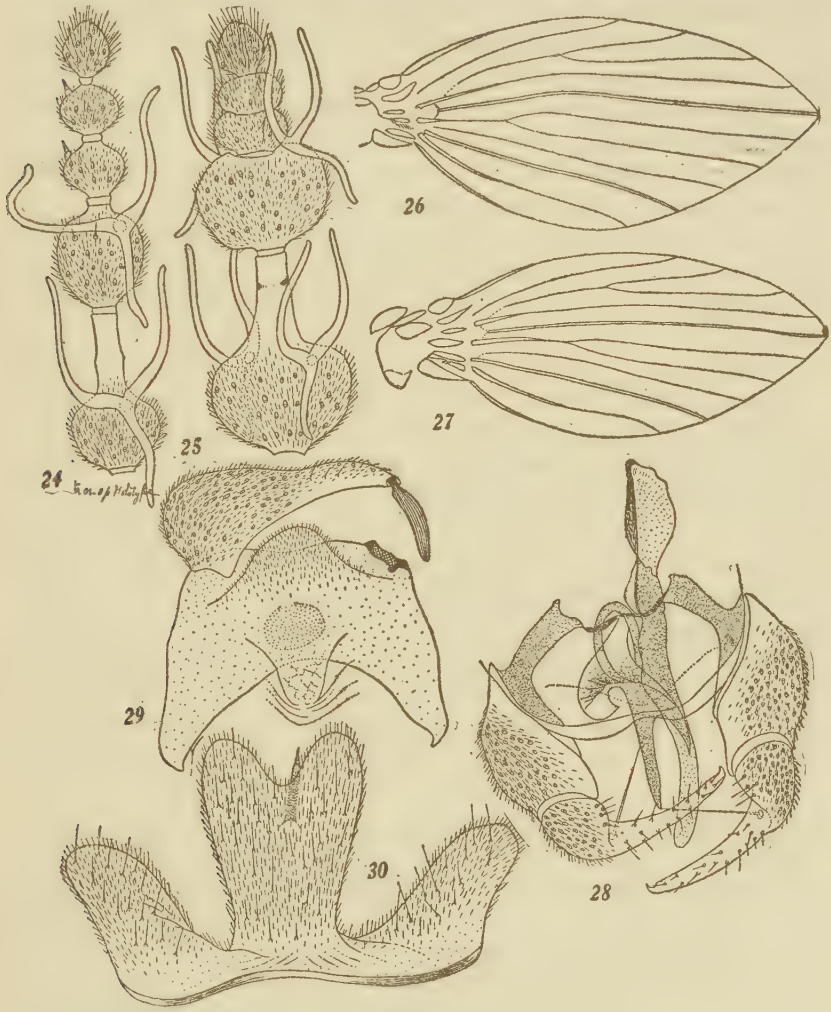
A rather large brownish gray species; male wings with pale small scales on basal quarter. Antennæ 16-segmented, all ascoids Y-shaped and present on segments 3 to 13, distal four segments without neck parts, two penultimate segments spherical and each with a minute cone, ultimate oval and as large as two penultimate. Wings rather broad, with two forks complete, median fork far before radial fork; male wings with small scales on basal one-fourth but female wings without scales. Male hypopygium with cerci rather short, stout and each with an apical retinaculum, styles scaly on swollen basal one-third, each with a rather long seta before middle and apical two-thirds rather slender, ædeagus rather long, not strongly curved and round at tip, accessory piece unequally bifurcated and extending caudad along ædeagus beyond ninth sternite which is very broad and grabrous. Female subgenital plate longer than wide, more or less narrowed at base, bilobated only at apical part, inner rod rather slender and arised on distal one-third of the plate, sternite very widely separated into lateral lobes by a large caudal concavity where the subgenital plate arises.

Male.—Body, about 1.61 mm long. Wings, about 1.75 by 0.82 mm. General coloration brownish gray in dry state and pale brown in mounted state; wings with small pale brown scales on basal quarter.

Head with eyes separated above as wide as one facet or slightly less, without eye-bridge. Maxillary palpi with four segments in relative length of 23.5:30:37:43. Antennæ (Fig. 24) 16-segmented, with ascoids all Y-shaped and present on segments 3 to 13, neck parts slightly longer than basal nodes and present on segments 3 to 12, apical four segments distinctly separated; four-

teenth and fifteenth segments spherical, far smaller than preceding, with many verticils and each with a minute cone; ultimate segment as large as preceding two, short-oval and with verticils; relative lengths of distal eight segments about 27:26:25:24:14:-8:7:8.

Legs with femora, tibiæ and tarsal segments in proportion of 108:116:51:22:17.5:14.5:18.5 in fore, 119:159.5:63:25.5:18.5:15:17.5 in middle and 132:176:67:25.5:19.5:15.5:19.5 in hind leg. Wings (Fig. 26) brownish, rather broad, with small



Psychoda bifurcata sp. nov.

FIG. 24. Apical segments of male antenna; 25, apical segments of female antenna; 26, male wing; 27, female wing; 28, dorsal part of male hypopygium; 29, ventral part of male hypopygium; 30, female subgenital plate.

pale brown scales on basal quarter and tufts of slender scales on tegulæ; venation; both forks complete, R_1 ending above or slightly beyond tip of Cu_1, radial fork distinctly beyond median fork, relative lengths of R_{2+3}, R_2, M_{1+2} and M_2, about 40:38:30:74.

Hypopygium (Figs. 28 and 29) with ninth tergite shorter than wide; cerci short, stout, expanded basally, tapered on apical two-fifths and each with a large apical retinaculum which is about 0.42 as long as cercus (21:50); sternite almost as large as tergite and quite bare; coxites well developed about 0.64 as long as cerci (32 × 24.5:50); styles large, slightly shorter than cerci (47:50), thickened and scaly on basal one-third, slender and tapered on apical two-thirds and each with a rather long seta before middle; ædeagus rather slender, not strongly curved and round at tip, its accessory piece large, unequally bifurcated on apical half, extending along ædeagus and far beyond sternite.

Female.—Body, length about 2.29 mm. Wings, about 1.77 by 0.84 mm. Coloration and general structure closely as in male with usual sexual differences, but wings without scales on basal areas.

Head with eyes separated above as wide as one or one and half facets from each other. Maxillary palpi with four segments in relative length of 24:24.3:27.3:3:34. Antennæ (Fig. 25) with neck parts of segments 3 to 13 rather short and shorter than basal nodes, apical four segments well separated from each other by sutures, fourteenth and fifteenth segments somewhat discoidal differing slightly from those of male; relative lengths of distal eight segments about 23.5:23.3:20.5:18:12.5:5.5:5:5.

Leg-segments except for coxæ and trochanters in proportion of 119.7:118.3:42:19.7:17:14.7:19 in fore, 138:159.3:51.7:23:18:15.7:18.3 in middle and 149.7:183:52.7:23:18.3:15.7:20.7 in hind leg. Wings (Fig. 27) broad, but not so broad as in male, without scales on basal areas, but tegulæ with tufts of slender setæ; venation similar in male, relative lengths of R_{2+3}, R_2, M_{1+2} and M_2 about 45.8:39:35.8:71.8.

Subgenital plate (Fig. 30) longer than width (38.8:28.5), basally narrowed and broadened apically (16.5:28.5) and sometimes subcordiform, apically bilobated into semicircular lobes by a rather shallow U-shaped caudal incision, entirely setigerous and pubescent, with inner rod slender, arising from pre-apical part and extending into caudal incision; sternite subdivided into paired lateral lobes, which are setigerous on mesal parts, by a very broad large caudal concavity where the subgenital plate

arises; ovipositor long, slender and about 2.4 times as long as subgenital plate (94.5:38.8).

Holotype.—Male; Naha vicinity, Okinawa, Ryukyu Islands; February 12, 1955 (*P. Arnaud,* by light trap).

Allotype.—Female with holotype.

Paratypes.—A female at same place; January 23, 1955. A female at same place; February 5 to 6, 1955. Three males and three females with holotype.

Locality.—Ryukyu Islands, Japan.

This species is related to Australian *Psychoda squamata* Satchell and *P. subpennata* Satchell in the structure of the male hypopygium, but in these two allied species the accessory piece of the ædeagus is not bifurcated but simple and the wing is provided with a reflected flap at base of costa which bears a tuft scales or hairs and the ultimate antannal segments of both sexes are quite spherical and as large as the preceding two segments, all differing distinctly from the present species. The structure of the female subgenital plate of the present species very closely resembles to that of Formosan *Psychoda subquadratilobata* Tokunaga, but the other structures such as antennæ and wings are quite different from each other.

PSYCHODA SHIKOKUENSIS sp. nov.

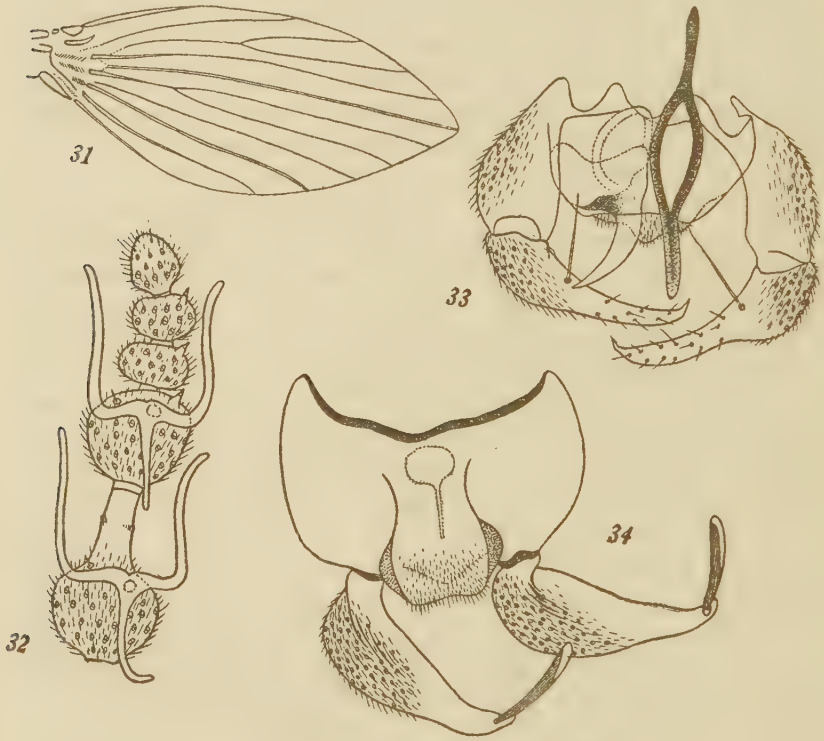
A pale brownish gray medium-sized species. Antennæ 16-segmented, all segments distinctly separated; fourteenth and fifteenth segments subequal, discoidal and each with a minute cone. Wings with both forks complete and R_1 ending above tip of Cu_1. Male hypopygium with cerci as long as ninth tergite and with single long retinacula; styles swollen and scaly basally and each with a rather long seta before middle and very sharply pointed at tip; sternite quite bare; ædeagus slender and almost straight; paramere curved and tapered.

Male.—Body, about 1.5 mm long. Wings, about 1.52 by 0.68 mm.

Head with eyes separated above from each other as wide as or slightly narrower than a facet. Maxillary palpi with four segments of relative lengths about 23:28:32:38. Antennæ (Fig. 32) distinctly 16-segmented, with ascoids all Y-shaped and present on segments 3 to 13 and neck parts on segments 3 to 12; thirteenth segment subspherical, as large as basal node of preceding segment, with many verticils and a pre-apical minute cone; following two discoidal, equal, with many verticils and a minute cone on each distal part; ultimate as large as pre-

ceding, oval and with verticils; relative lengths of distal eight segments about 28:28:26:23:14:6:6:7.

Legs with femora tibiæ and five tarsal segments in proportion of 91:105:46:19:16:14:16 in fore, 100:130:58:21:16:14:15 in middle and 108:158:68:22:17:14:16 in hind leg. Wings (Fig. 31) with R_1 ending at level of tip of Cu_1, radial fork complete and distinctly beyond complete median fork and far before tip of R_1, relative length of R_{2+3}, R_2 and R_3 about 36:31:46 and those of M_{1+2} and M_2 about 25:65.



***Psychoda shikokuensis* sp. nov. (Male).**

FIG. 31. Wing, 32; apical segments of antenna; 33, dorsal part of hypopygium; 34, ventral part of hypopygium.

Hypopygium (Figs. 33 and 34) with ninth tergite wider than long; cerci subequal in length to tergite, stout, distinctly tapered and each with a slender long apical retinaculum which is about 0.43 as long as cercus (18:42) sternite shorter than wide and quite bare; coxite about 0.67 as long as cerci (28:42) and scaly on lateral sides; styles longer than coxites (38:28), scaly and swollen on basal parts, tapered and with

scattered minute setæ on apical parts and each with a rather long seta before middle, extreme tip of style sharply pointed and curved; ædeagus and apodeme almost straight, their total length slightly longer than cerci (52:42) and swollen at base of ædeagus; paramere tapered, curved, a little shorter than coxites (24:28) and extending caudal as long as ædeagus.

Female.—Unknown.

Holotype.—Male; Matsuyama, Ehime Prefecture; October 31, 1951 (*M. Tokunaga*).

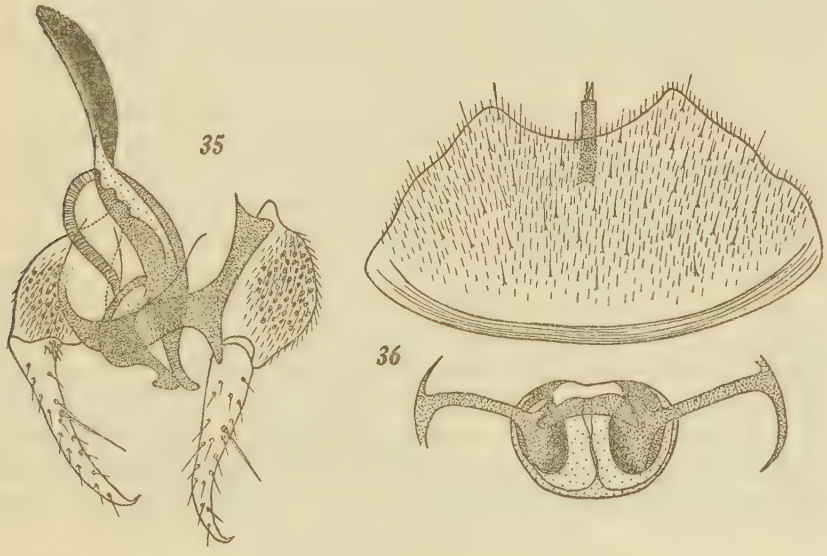
Locality.—Shikoku, Japan.

This is very closely allied to Australian *Psychoda squamata* Satchell and Japanese *P. longiseta* Tokunaga et Etsuko. However in the first allied species the wings are provided with scales on basal areas and in the second allied species the styles of the male hypopygium are not swollen and devoid of scales basally differing from the present species. Another allied species may be *P. bifurcata* Tokunaga, but it is different in the following points: the wing base is scaly and the paramere of the male hypopygium is distinctly different in shape.

PSYCHODA FUNGICOLA Tokunaga.

P. longiseta TOKUNAGA and KOMYO, Philip. Jour. Sci. 83 (1954)

A medium-sized brownish gray species, one of the important injurious pests of Japanese pine mushroom. Antennæ 16-segmented, with ascoids all Y-shaped and present on segments 3 to 13, neck parts on segments 3 to 12; thirteenth segment as



***Psychoda fungicola* Tokunaga**

FIG. 35. Dorsal part of male hypopygium; 36, female subgenital plate and spermathecæ.

large as basal node of preceding segment and with a minute cone; following two segments equal, far smaller than preceding, not separated by joint, with verticils and each with a minute cone; ultimate segment oval and several verticils. Wings with radial fork beyond median fork and about at middle of wing, relative lengths of R_{2+3}, R_2 and R_3 about 49:36.3:55 in female and 54:32:47 in male, those of M_{1+2}, M_1 and M_2 about 30:82.3:74.7 in female and 31.5:82.5:72.5 in male. Male hypopygium (Fig. 35) with cerci stout, as long as ninth tergite and each with an apical retinaculum; ninth sternite square, bare, thickened along caudal margin and with a conelike process; coxites rather short and with scales on lateral swollen parts; styles longer than coxites, slender, tapered, sharply pointed and curved at tip, with scattered minute setæ, each with a group of very minute setæ at base and a rather long seta at middle, but without scales, ædeagus tapered, slightly curved and not sharply pointed, its apodeme shorter than ædeagus; paramere far shorter than ædeagus, broad on basal half, tapered on apical half and curved at tip. Female subgenital plate (Fig. 36) very broad, far wider than long, setigerous, shallowly but broadly concave at caudal margin; inner rod rather long and cylindrical; spermathecæ without sculpture, with a pair of transverse bars.

Specimens.—Four females reared from larvæ; Kagawa Prefecture; October, 1953 (*A. Nobuchi*).

Distribution.—Honsyu (Kyoto, 1953) and Shikoku, Japan.

PSYCHODA LONGISETA Tokunaga et Etsuko.

P. longiseta TOKUNAGA and KOMYO, Philip. Jour. Sci. **83** (1954) 313–314.

A pale gray or whitish gray species, male about 1.2 to 1.4 mm long and female larger being 2.7 mm long. Antennæ 16-segmented, with all segments distinctly separated from each other by joints, ascoids all well developed on segments 3 to 13 and Y-shaped, neck parts present on segments 3 to 12; thirteenth spherical, as large as basal node of preceding segment and with a minute sensory cone and many verticils; distal three segments smaller than preceding, subequal, subspherical, with many verticils and fourteenth and fifteenth each with a minute sensory cone. Wings, about 1.2 to 1.3 mm long in male and 2 mm in female and about 2.33 and 2.35 times as long as wide respectively, with R_1 ending above tip of Cu_1, both forks complete, radial fork distinctly beyond median fork and before

tip of Cu_1, relative lengths of R_{2+3}, R_2 and R_3 about 27.3:19.9:26.8 and those of M_{1+2}, M_1 and M_2 about 17.5:43.5:39 in male and those of R_{2+3}, and R_2 about 49.6:40.5 in female. Male hypopygium with cerci as long as ninth tergite (60:58), tapered, moderately swollen basally and each with a rather slender apical retinaculum which is about one-third as long as cerci; coxites about half as long as cerci and scaly on lateral swollen parts; styles far shorter than coxites (20:30), tapered, slightly curved, pointed apically, with scattered minute setæ, each with a special long seta at middle which is fully twice as long as styles (44.20) and without scales even on basal parts; ædeagus tapered, almost straight, about twice as long as styles (42:20) and shorter than basal apodeme (42:50). Female subgenital plate setigerous, shorter than wide (35:65), with caudal lobes rather large, triangular and separated by a deep V-shaped caudal incision from each other; inner rod cylindrical, rather long, about half as long as the plate, arising from caudal margin of the plate and extending far caudad into caudal incision.

Specimens.—A female; Haruyoshi, Fukuoka Prefecture, Kyusyu (*S. Ito*). A female; Hachijyo, Kyoto City, Honsyu (*M. Tokunaga,* at light).

Distribution.—Honsyu and Kyusyu, Japan.

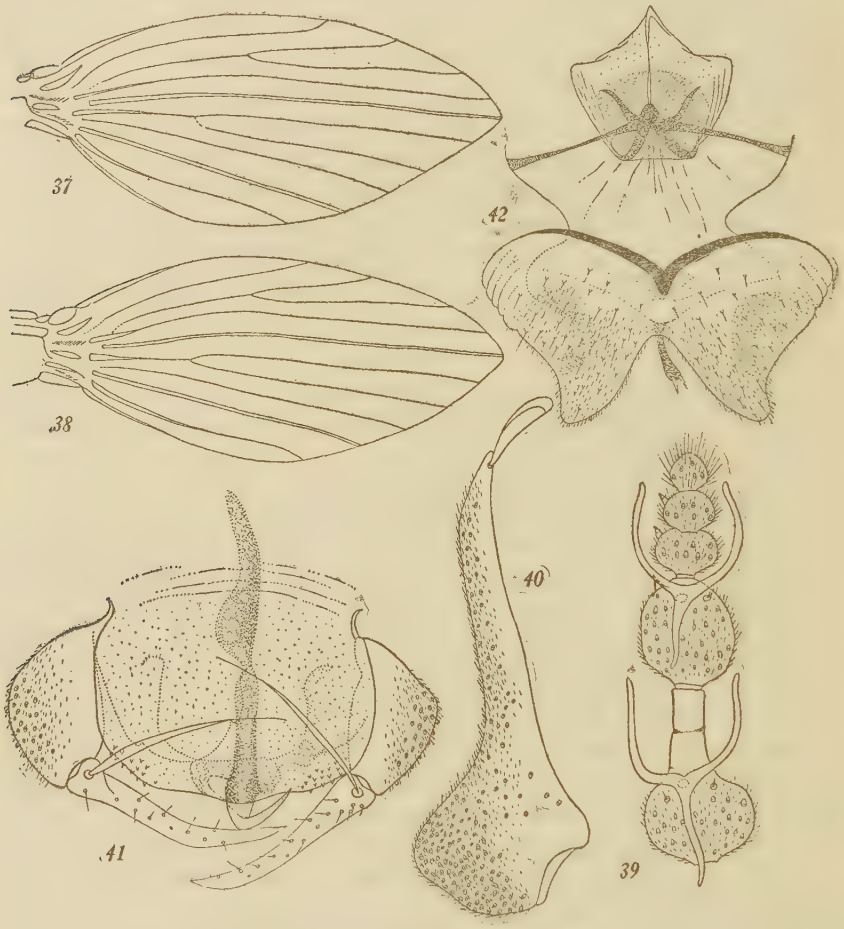
This species is so very closely allied to *Psychola hamatifera* Tokunaga as the females are almost indistinguishable from each other, but the males are different in the following points: in the allied species, styles more slender and with single isolated long setæ located at extreme bases, ædeagus strongly curved apically and paramere obscure.

PSYCHODA HAMATIFERA sp. nov.

A rather large pale brownish gray species. Antennæ 16-segmented, distal segments completely segmented, thirteenth and following segments without neck parts, distal three segments far smaller than preceding, subspherical, subequal or slightly unequal and all with verticils; antennal ascoids all Y-shaped and present on segments 3 to 13. Wings broad, without colored marking, with both forks complete or somewhat obscure, R_1 ending above or beyond tip of Cu_1 and radial fork distinctly beyond median one. Male hypopygium with cerci strongly expanded basally and with a single retinaculum at each tip, sternite very broad and with a pair of groups of

minute spinules on caudolateral parts; styles longer than coxites, slender and each with a very long flat seta at each base; ædeagus strongly curved upwards and sharply pointed.

Male.—Body length 1.66 (1.43 to 1.86) mm. Wings, 1.48 (1.39 to 1.69) by 0.74 (0.68 to 0.79) mm. General coloration pale brownish gray in dry specimen and pale brown in mounted state and wings without colored marking.



***Psychoda hamalifera* sp. nov.**

FIG. 37. Male wing; 38, female wing; 39, apical segments of male antenna; 40, male cercus; 41, dorsal part of male hypopygium; 42, female subgenital plate with spermathecæ.

Head with eyes separated above as wide as a facet or less than a facet from each other. Maxillary palpi with four segments in proportion of 22.2:23.8:23.4:31. Antennæ (Fig.

39) 16-segmented, with ascoids well developed, all Y-shaped and present on segments 3 to 13; distal four segments distinctly separated by a suture from each other, thirteenth segment short-oval or subspherical and without neck part, following two segments slightly shorter than wide, with verticils, but without neck part, ultimate segment slightly shorter than preceding, subspherical and with several verticils; relative lengths of antennal segments about 23:17:26:28:30:29:29:29:28:27:26:23:13.5:5:4.5:4.

Leg-segments from femora to tarsi in proportion of 98.7:103:33.3:17.3:14.3:11.7:16 in fore, 111:131:40.7:18.3:14:11.7:16.3 in middle and 118.7:137.3:41.3:19.3:15.3:12.3:16 in hind leg. Wings (Fig. 37) rather broad, pale brownish hyaline, R_1 ending distinctly beyond tip of Cu_1, radial fork far beyond median fork, relative lengths of R_{2+3}, R_2, R_3, M_{1+2}, and M_2 about 40.9:34.1:47.4:32.4:58.1.

Hypopygium (Figs. 40 and 41) with ninth sternite, very broad, wider than long, finely spinulous at laterocaudal parts and without setæ and pubescence; ninth tergite large, shorter than wide (50:58.3) and somewhat hexagonal; cerci very long, far longer than tergite (76:50), distinctly expanded basally and with single rather large retinacula at tips; coxites well developed (25.5×15.5), about half as long as tergite and scaly on lateral sides; styles slender, tapered, far longer than coxites (34.5:25.5), clawlike, with single very long basal setæ and many minute setæ ædeagus strongly curved upwards, sharply pointed, its distal external part as long as sternite and its basal internal part shorter than distal part, accessory pieces obscure, but one piece seems to extend along caudal margin of sternite and curved at pointed tip, but not extending caudad beyond the sternite.

Female.—Body length 1.96 (1.89 to 2.04) mm. Wings, 1.83 (1.59 to 2.02) by 0.78 (0.68 to 0.86) mm. General structure and coloration similar to those of male with usual sexual differences.

Head with eyes separated above as wide as one or one and half facets from each other and without eye-bridge. Maxillary palpi with four segments in proportion of 24:31:37:46. Antennæ very closely as in male, small cones on penultimate two segments more distinct than in male and ultimate segment with many verticils as in preceding two segments and as large

as them; relative lengths of antennal segments about 27:19:27:25:27.5:27.5:28.5:28:26:26:26:23:13:8:7:8.

Legs with segments except for coxæ and trochanters in proportion of 113.5:119.5:50:22.5:17.5:16:20.5 in fore, 119.5:166.5:64.5:24:18.5:15.5:21.5 in middle and 134.5:181.5:70:25.5:20:16:21.5 in hind leg. Wings (Fig. 38) somewhat narrower than in male, slightly more brownish than in male, R_1 ending above or just beyond tip of Cu_1, median fork far before radial fork; relative lengths of R_1 and Cu_1 about 65.7:65.3, those of R_{2+3}, R_2 and R_3 44:35.7:63 and of M_{1+2} and M_2 30:78.3.

Subgenital plate (Fig. 42) shorter than wide (30.3:55.3), subdivided into paired subtriangular lateral lobes, which are somewhat pointed caudad and separated by a large and deep V-shaped median caudal incision from each other, basal margin of subgenital plate thickly chitinized and slightly concave; inner rod rather long, about half as long as paired lateral lobes (16:30.3), slightly clavated, arised just before the bottom of caudal median incision and visible in ventral aspect; sternite obscure being broadly fused with subgenital plate; ovipositor long and about 2.6 times as long as the plate (78.6:30.3).

Holotype.—Male; Naha vicinity, Okinawa, Ryukyu Islands; February 12, 1955 (*P. Arnaud,* by light trap).

Allotype.—Female at same place to holotype; January to February, 1955 (*P. Arnaud*).

Paratypes.—Four males at same place to holotype; February 5 to 9, 1955 (*Arnaud,* by light trap). Two females at same place to holotype; January to February, 1955 (*P. Arnaud,* by light trap).

Locality.—Ryukyu Islands, Japan.

This species is closely allied to *Psychoda longiseta* Tokunaga et Etsuko; the females of these two species are so very closely resemble to each other that it is difficult to point out the specific difference, but the males are distinctly different in the following points of the hypopygium from each other: in the allied species the ædeagus is almost straight and not curved, the styles are provided with long setæ at middle and not at bases and the cerci are relatively short and as long as the ninth tergite and not suddenly expanded at bases but stout and tapered.

PSYCHODA TRILOBATA sp. nov.

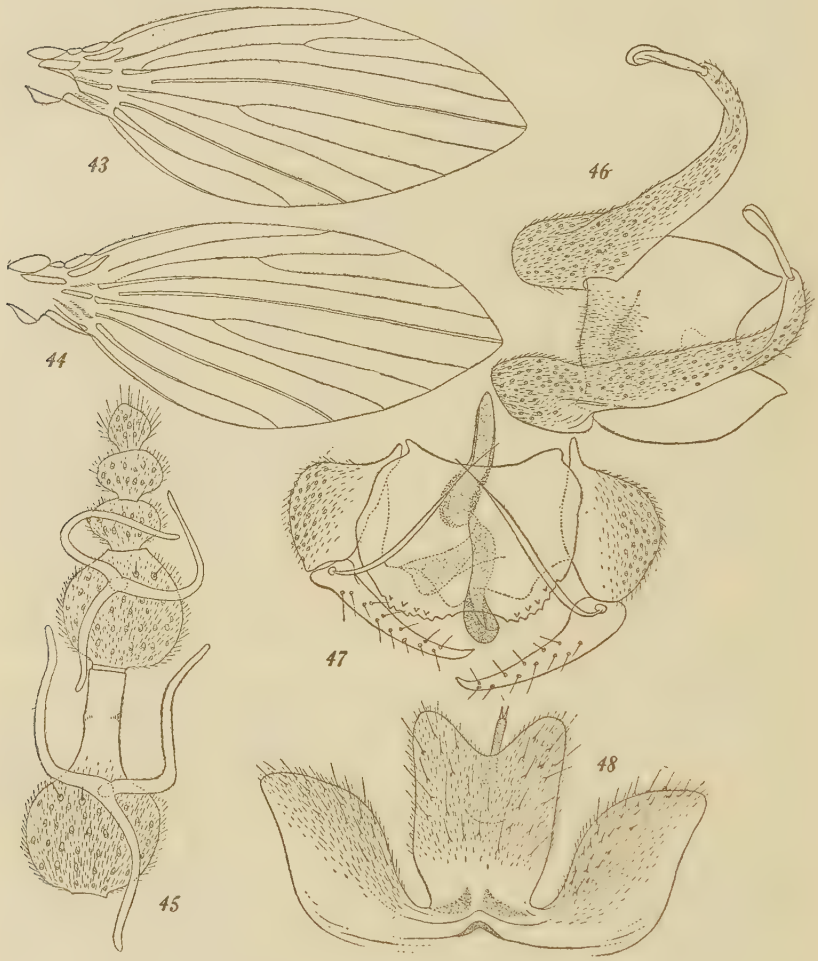
A medium-sized species, pale brownish gray in dry state and pale brown in mounted state. General structure similar to that of *Psychoda longiseta* Tokunaga et Etsuko and *P. hamatifera* Tokunaga, but female subgenital plate highly different from that of these two species. Antennæ 16-segmented, with ascoids all well developed, Y-shaped and present on segments 3 to 13; distal three segments far smaller than preceding one, with many verticils and separated from each other by distinct sutures, fourteenth and fifteenth somewhat discoidal and ultimate short-oval. Wings with radial and median forks complete, the former far beyond the latter and slightly or far before tip of Cu_1, R_1 ending slightly or far before tip of M_4. Male hypopygium with cerci far longer than ninth tergite, distinctly swollen basally and with a single long retinaculum at each tip; styles slightly arcuated, pointed apically, clawlike, each with a very long seta on extreme base, ædeagus rather short and round apically, paramere obscure; ninth sternite subsquare and with many minute tubercules on laterocaudal areas. Female subgenital plate longer than wide, somewhat narrowed basally, with two lateral margins almost parallel, caudal lobes fish-tail-like, rather short, round at tip and separated by a broad V-shaped caudal incision from each other; sternite very widely separated into lateral lobes, which are setigerous on mesal area, by a very broad caudomedian depression from which subgenital plate arises.

Male.—Body, about 1.56 mm long. Wings, about 1.33 by 0.6 mm. General coloration pale brownish gray in dry state.

Head with eyes separated above as wide as a facet from each other and eye-bridge absent. Maxillary palpi with four segments in proportion of 19:19:22:25. Antennæ (Fig. 45) 16-segmented, with all segments completely separated, ascoids all Y-shaped and developed on segments 3 to 13, neck parts present on segments 3 to 12; thirteenth segment subspherical, as large as basal node of preceding one and with many verticils; following two subequal, somewhat discoidal and with many ultimate short-oval, shorter than preceding and with many verticils; relative lengths of basal four and distal eight segments about 19:15:27:25 and 23:23:23:20:15:5.5:5:4.

Legs with segments excepting basal two, in proportion of 89:95:30:15:12:11:14 in fore, 91:120:34:14:12:11:14 in middle and 106:127:34:17:13:12:14 in hind leg. Wings (Fig. 43)

with vein R_1 ending between tips of M_4 and Cui_1, both forks complete, radial fork slight before tip of Cu_1 and far beyond median fork; relative lengths of R_{2+3}, R_2 and R_3 about 37:26:36, those of M_{1+2} and M_2 about 30:48.



***Psychoda trilobata* sp. nov.**

FIG. 43. Male wing; 44, female wing; 45, apical segments of male antenna; 46, ventral part of male hypopygium; 47, dorsal part of male hypopygium; 48, female subgenital plate.

Hypopygium (Figs. 46 and 47) with ninth tergite subsquare (45 × 50), cerci about 1.6 times as long as tergite (70:45), basally swollen and each with a long apical retinaculum which

is about 0.23 as long as cercus; ninth sternite broad, with several minute tubercules on either laterocaudal margin; coxites well developed (22 × 13) and scaly on lateral swollen sides; styles distinctly longer than coxites (29:22), tapered, clawlike, with scattered minute setæ and single very long setæ at bases which are far longer than styles (34:29); ædeagus and apodeme very slightly curved and subequal in length (25:25); apical end of aedeagus round and not strongly curved.

Female.—Body, about 1.56 mm long. Wings, about 1.22 by 0.56 mm. Coloration generally brownish gray and general structure closely similar to that of male with usual sexual differences.

Head with eyes separated above as wide as two facets from each other. Maxillary palpal segments about 16:16:16:22 in relative lengths. Antennæ with basal four and apical eight segments in proportion of 15:12:16:16 and 16:16:16:15:9:4:4:4 respectively. Wings (Fig. 44) with R_1 ending slightly before tip of M_4, relative lengths of R_{2+3}, R_2 and R_3 about 28:27:37 and those of M_{1+2}, and M_2 about 26:44. Legs with segments excepting coxæ and trochanters in proportion of 72:70:24:12:10:9:12 in fore, 77:100:30:13:12:9:12 in middle and 88:106:28:13:12:10:14 in hind leg. Subgenital plate (Fig. 48) slightly narrowed basally, longer than wide (25:19), setigerous, with caudal lobes subtriangular but round at tips and widely separated from each other by a broad V-shape caudal median incision; inner rod cylindrical, rather long and extending into caudal incision, sternite very broadly concave at caudomesal margin and subdivided into paired lateral parts which are setigerous on mesal margins.

Holotype.—Male; Matsuyama, Ehime Prefecture; October 31, 1951 (*M. Tokunaga*).

Allotype.—Female with holotype.

Paratype.—A female with holotype.

Locality.—Shikoku, Japan.

This species is somewhat allied to *Psychoda longiseta* Tokunaga et Etsuko and *P. hamatifera* Tokunaga especially in the structure of the male hypopygia, but in the first allied species cerci are rather shorter being only as long as ninth tergite and styles are provided with single long setæ at middle of styles distinctly differing from the present species.

The female of the new species are quite different from these two allied species in the structure of the subgenital plate and sternite.

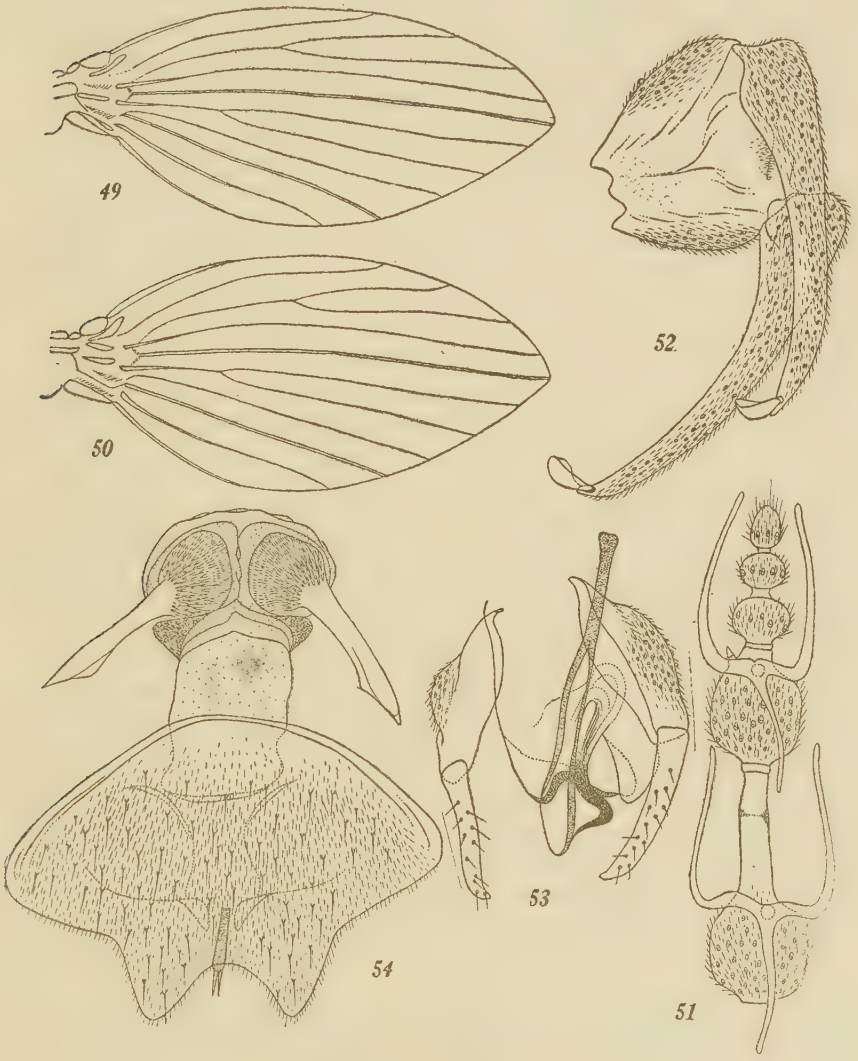
PSYCHODA NIGRIVENTRIS sp. nov.

A rather large or medium-sized brownish gray species; males with dark brown scales on abdominal sternites and small scales at bases of wings. Antennæ 16-segmented, with well developed Y-shape ascoids on segments 3 to 13, neck parts rather long, longer than basal nodes and present on segments 3 to 12; all segments distinctly separated from each other by joints; thirteenth segment with a pre-apical small cone and short neck part; following two subdiscoidal, far smaller than preceding and slightly unequal; ultimate smaller, oval and with several verticils. Wings rather broad, with R_1 ending slightly before tip of M_4, radial and median forks complete and the former distinctly beyond the latter and slightly before tip of Cu_1. Legs of male with dark brown scales on tibiæ and tarsi. Male hypopygium with cerci not distinctly swollen basally, far longer than tergite and with a broad retinaculum at each tip; styles slender, without scales and special long setæ; ædeagus and apodeme almost straight and slightly swollen apically; paramere strongly curved twice on apical half and sharply pointed. Female subgenital plate very broad, setigerous, caudal one-third bilobated into subtriangular lobes which are very widely separated from each other by a semicircular median caudal incision; inner rod cylindrical, rather long; spermathecæ subspherical, with reticulation of sculpture on surface and each with a large chitinized rod.

Male.—Body, about 1.86 (1.63 to 2.02) mm long. Wings, about 1.66 (1.5 to 1.74) by 0.75 (0.68 to 0.81) mm. General coloration brownish gray in dry state, pale brown in mounted state, but legs and abdominal sternite with many dark brown scales.

Head with eyes separated above from each other as wide as or slightly less than a facet and without eye-bridge. Maxillary palpi with four segments in proportion of 22.3:27:26.2:34.3. Antennæ (Fig. 51) 16-segmented, with ascoids well developed on segments 3 to 13, neck parts longer than basal nodes and present on segments 3 to 12; distal four segments completely separated by joints; thirteenth segment with a short but distinct neck part and a small pre-apical cone; following

subdiscoidal, far smaller than preceding and with about twelve verticils; fifteenth subequal to preceding, but somewhat smaller and with about ten verticils; ultimate smaller than penultimate, oval and with several verticils; relative lengths of basal four and distal eight segments about 26.3:17.3:34:34.7 and 35.3:34:32.7:29.3:15.3:6.3:5.8:6.5 respectively.



***Psychoda nigriventris* sp. nov.**

Fig. 49. Male wing; 50, female wing; 51, apical segments of male antenna; 52, ventral part of male hypopygium; 53, dorsal part of male hypopygium; 54, female subgenital plate with spermathecæ.

Legs with dark brown scales on tibiæ and tarsi, main segments excepting coxæ and trochanters in proportional length of 100.3:110.7:39:19:15.7:12.7:17.7 in fore, 116.7:148:44.3:20:14.7:12.7:17.7 in middle and 127.7:159:43.7:20.3:16.3:13:17.7 in hind leg. Wings (Fig. 49) with pale brown small scales at bases; tegulæ with tufts of slender scales; venation: R_1 ending far beyond and sometimes more or less beyond tip of Cu_1, both forks complete, radial fork distinctly beyond median fork and slightly before level of tip of Cu_1, relative lengths of R_{2+3}, R_2 and R_3 about 38.7:40.3:52.3 and those of M_{1+2}, M_1 and M_2 about 28:79.7:71.7.

Hypopygium (Figs. 52 and 53) with ninth tergite subcordiform, shorter than wide (53.3:58.3) and narrowed at base; cerci about 1.9 times as long as tergite (100.3:53.3), not distinctly swollen basally, tapered, arcuated and each with a short but broad retinaculum at tip; ninth sternite subsquare (36×35) and quite bare; coxites shorter than sternite (31.7:36), rather slender and scaly on lateral convex areas; styles slender, slightly shorter than coxites (29.7:31.7), almost cylindrical, tapered only at tip, not sharply pointed, with many scattered minute setæ but without scales and special long setæ; ædeagus and apodeme almost straight and subequal in length to each other (30.3:29.7), the former somewhat clavated apically; paramere longer than ædeagus (36:30.3), strongly curved twice on apical half, sharply pointed and not beyond tip of ædeagus.

Female.—Body, about 1.96 mm. long. Wings, about 1.86 by 0.85 mm. General coloration paler than in male and other structures closely as in male with usual sexual differences.

Head with eyes separated above as wide as one facet or sligthly more from each other. Maxillary palpi with four segments in proportion of 23:28.5:26.5:35.5. Antennæ closely as in male; neck parts of segments 3 to 12 as long as basal nodes; relative lengths of basal four and distal eight segments about 25.5:17:26.5:26.5 and 28.5:28:26.5:25:14.5:5.8:5.5:6 respectively.

Legs with pale brown scales or tibiæ and tarsi; femora, tibiæ and five tarsal segments in proportion of 109:116:38.5:20.5:16.5:14.5:20.5 in fore, 133:172.5:47.5:21:18:14.5:20.8 in middle and 139.5:181:45:21:18:14.5:20:5 in hind leg. Wings (Fig. 50) far broader than in male, without scales at

bases, relative lengths of R_{2+3}, R_2 and R_3 about 46:43.3:60 and those of M_{1+2}, M_1 and M_2 about 29.5:90:81.5.

Subgenital plate (Fig. 54) broad, entirely setigerous, shorter than wide (39.5:56.5), strongly narrowed caudad, completely fused with sternite, with lateral sides shallowly concave; paired caudal lobes very short, about a quarter as long as genital plate, subtriangular but not sharply pointed, separated from each other by a broad semicircular median incision; inner rod as long as caudal lobes (11:10.5), cylindrical and just beyond margin of caudal incision; spermathecæ subspherical, intimately contiguous with each other forming an oval mass, fine sculpture on surface and each with a strong rod; ovipositor long and about 1.6 times as long as subgenital plate (61.5:39.5).

Holotype.—Male reared from larva; Saijyo, Hiroshima Prefecture; June 1, 1956 (*M. Kiyoku*).

Allotype.—Female reared with holotype.

Paratypes.—Four males and five females reared with holotype.

Host plant.—Japanese pine mushroom.

Locality.—Honsyu, Japan.

This species is only found in Hiroshima Prefecture at present and one of the important pests of Japanese pine mushroom. The new species is allied to *Psychoda itoco* Tokunaga et Etsuko and *P. motoharui* Tokunaga et Etsuko in the main specific structures of the male, but these two allied species are provided with the parameres of the male hypopygia are distinctly arcuated and sicklelike and the ædeaga are flattened vertically and strongly curved dorsad on their apical parts notably differing from the new species. The female of the present species resembles to that of *Psychoda fungicola* Tokunaga, but in the allied species the penultimate two antennal segments of both sexes are fused with each other and without a suture between them and the spermathecæ are not provided with distinct sculpture on the surface distinctly differing from the present species.

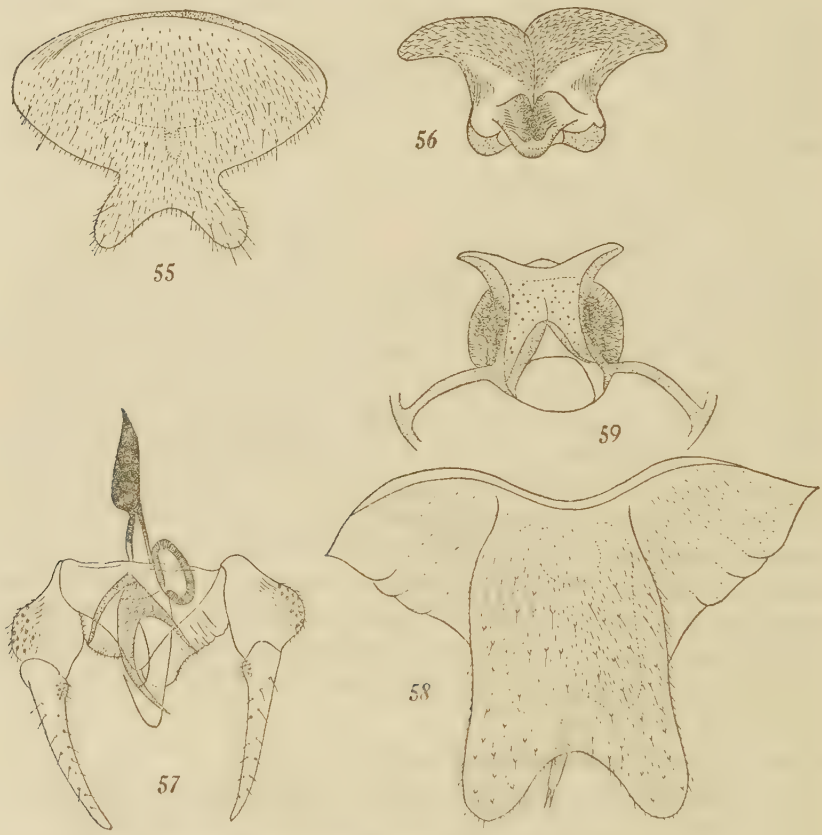
PSYCHODA MOTOHARUI Tokunaga et Etsuko.

P. motoharui TOKUNAGA and KOMYO, Philip. Jour. Sci. 83 (1954) 314–316.

This species is very closely allied to *Psychoda itoco* Tokunaga et Etsuko in specific characters of male, but the female of this

species is highly characteristic in the structures of the subgenital plate and the spermathecæ.

The male is different from allied species in the following points: antennal segments 14 and 15 fused with each other and without joint between them and styles of male hypopygium without groups of minute setæ at bases or with groups of three on four minute setæ at bases. The characteristic structures of female subgenital plate and spermathecæ are as follows: genital plate (Fig. 55) broad, oval on basal area, setigerous and with a pair of caudal lobes which are divergent and round at tips; inner rod small, twice as long as wide and located at middle of genital plate; spermathecæ (Fig. 56) with fine reticulation on surface.



***Psychoda motoharui* Tokunaga et Etsuko (Female).**

FIG. 55. Subgenital plate; 56, spermathecæ.

***Psychoda itoko* Tokunaga et Etsuko.**

FIG. 57. Dorsal part of male hypopygium; 58, female subgenital plate; 59, spermathecæ.

Specimen.—A female; Ashoro, Hokkaido; June 16, 1954; M. *Sasakawa.*

Distribution.—Honsyu (Kyoto in 1954) and Hokkaido, Japan.

PSYCHODA ITOCO Tokunaga et Etsuko.

P. itoco TOKUNAGA and KOMYO, Philip. Jour. Sci. 83 (1954) 312–313.

A medium-sized or rather large pale gray species, very widely distributed and abundant in Japan. Antennæ 16-segmented, distal four segments distinctly separated from each other and without neck parts; ascoids all Y-shaped and present on segments 3 to 13; thirteenth segment as large as basal node of preceding segment, following two subequal, somewhat discoidal and each with several verticils but without cones; ultimate segment smaller than preceding, oval and with several verticils. Wings with radial and median forks complete, the former slightly beyond the latter, R_1 ending above or slightly beyond tip of Cu_1, R_{2+3}, usually longer than R_2 (55.4:46.6 in female and 43:37 in male). Male hypopygium (Fig. 57) with cerci long, about 2.5 times as long as styles, slender, not swollen basally and with a single retinaculum at each tip; ninth sternite subtriangular, but round at caudal tip and quite bare; styles slender, tapered, far longer than coxites (40:25), very slightly curved, each with a group of seven or eight minute setæ at basal ventromesal corner and scattered minute setæ, but without scales and special long setæ; ædeagus flattened laterad and curved dorsad on apical part; paramere sicklelike and sharply pointed. Female subgenital plate (Fig. 58) longer than wide (38:26.5), basally fused with membranous sternite which is not provided with setæ, median part, which is true subgenital plate, setigerous, bilobated apically into rather short and apically round lobes by a large subtriangular or semicircular caudal median incision; inner rod arising slightly before caudal margin of the plate, rather long, cylindrical and extending into caudal incision; spermathecæ (Fig. 59) fused with each other forming a round mass, supported by a pair of chitinized framework; ovipositor normal about 1.7 times as long as subgenital plate (64:38).

Specimens.—A female; Ohiso, Kanagawa Prefecture; May 18, 1942 (*Y. Hasegawa* at light). A female; Takatsuki, Osaka; January 2, 1949 (*S. Ito.*) A female; Takatsuki, Osaka; May 3, 1949 (*S. Ito*). Four females; Dogo, Ehime Prefecture; August 8, 1949 (*M. Miyatake*). Three females; Matsuyama, Ehime

Prefecture; May 10, 1952 (*T. Yano*). A female; Inu-u-in-Mura, Ehime Prefecture; April 13, 1949 (*M. Miyatake*). A female; Matsuyama, Ehime Prefecture; October 31, 1951 (*M. Tokunaga*). Three females; Tokyo; December 6 to 11, 1951 (*N. Fukuhara*). A male and two females; Naha Vicinity, Okinawa; January to February, 1955 (*P. Arnaud*, by light trap). A female; Nukabira, Hokkaido; June 13, 1954 (*M. Sasakawa*).

Distribution.—Hokkaido, Honsyu, Shikoku and Okinawa, Japan.

Body length and wing size rather variable, wings being about 2.12 (1.27 to 2.44) by 0.91 (0.5 to 1.05) mm in female and about 1.65 by 0.74 mm in male. Related to the wing venation, in the original report, R_{2+3} is equal to R_2 in length, however, the relative lengths of these two veins are rather variable and usually R_{2+3} is somewhat longer than R_2. Male hypopygium is very closely similar to that of *Psychoda motoharui* Tokunaga et Etsuko, but in the present species the styles are provided with more distinct groups of minute setæ at ventromesal corners of extreme bases.

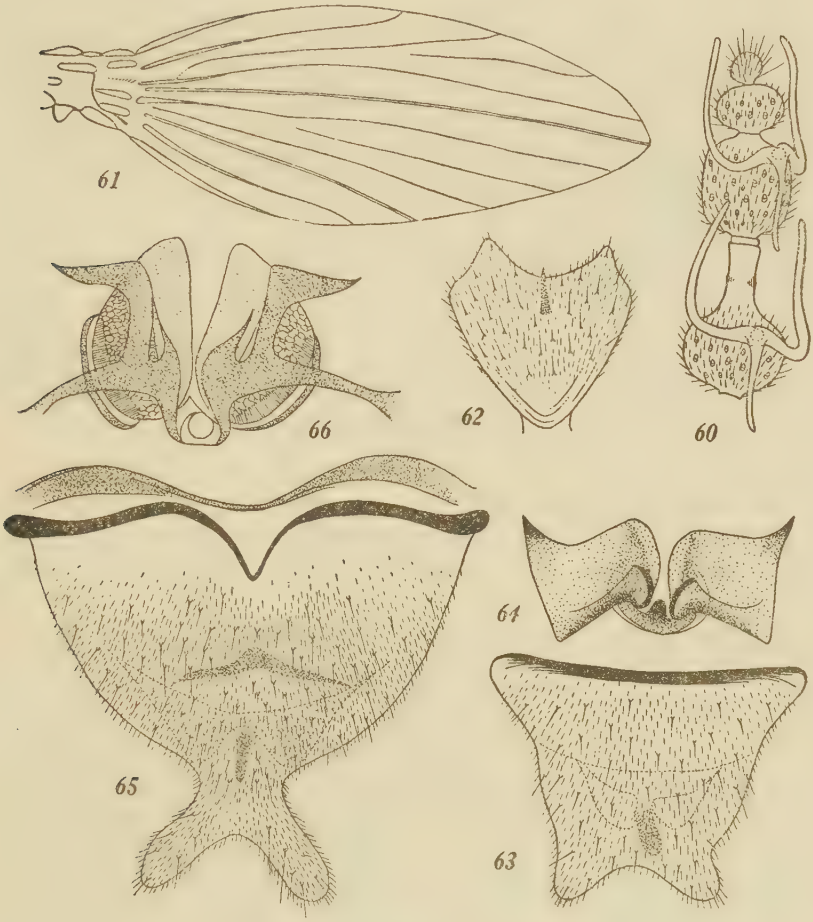
PSYCHODA Ja–No. 1.

A rather small pale brownish gray species. Antennæ 15-segmented, with ascoids all Y–shaped and present on segments 3 to 13, neck parts on segments 3 to 12; distal three segments separated by sutures from each other, of which fourteenth is discoidal and ultimate minute and spherical. Wings with radial and median forks incomplete, R_3 and M_2 basally atrophied. Female subgenital plate somewhat shield-shaped, narrowed basally, setigerous, with paired caudal lobes small and triangular; inner rod conical and rather long but not far beyond caudal margin of the plate.

Female.—Body length, about 1.43 mm. Wings, about 1.48 by 0.6 mm. Generally pale brownish gray in dry state.

Head with eyes separated above as wide as half a facet from each other. Maxillary palpal segments about 19:21:20:25 in relative length. Antennæ (Fig. 60) 15-segmented, with ascoids all well developed on segments 3 to 13 and Y-shaped, neck parts rather short and present on segments 3 to 12, all verticils finely plumous on apical parts, distal three segments all separated by sutures from each other; thirteenth segment a little larger than basal node of preceding segment and

slightly longer than wide; penultimate discoidal, far smaller than preceding and with about twenty verticils; ultimate minute, spherical and without verticils, relative lengths of distal eight segments about 17:17:17:15:14:9:4:3.5.



***Psychoda* Jp-No. 1. (Female).**

FIG. 60. Apical segments of antenna; 61, Wing; 62, subgenital plate.

***Psychoda* Jp-No. 2. (Female).**

FIG. 63. Subgenital plate; 64, spermathecæ.

***Psychoda* Jp-No. 3. (Female).**

FIG. 65. Subgenital plate; 66; spermathecæ.

Legs with femora, tibiæ and five tarsal segments in proportion of 80:85:30:14:12:10:14 in fore, 83:106:39:17:13:11:15 in middle and 94:125:42:17:13:11:14 in hind leg. Wings (Fig. 61) without scales, with vein R_1 ending above or beyond

tip of Cu_1, radial and median forks incomplete, R_3 and M_2 basally atrophied, R_3 arising from level of tip of M_4, relative lengths of R_1 and Cu_1 about 57:55, those of R_{2+3} and R_2 taken together and R_3 about 67:33 and those of M_{1+2} and M_1 taken together and M_2 about 95:54.

Subgenital plate (Fig. 62) shieldlike, setigerous, basally narrowed, dilated caudad, ending into caudal lobes which are short, somewhat pointed, subtriangular and widely separated by a shallow lunate median incision; inner rod conical, slender and just beyond caudal margin of the plate; ovipositor about twice as long as subgenital plate (60:26).

Male.—Unknown.

Specimen.—A female; Ohiso, Kanagawa Prefecture; May 18, 1942 (*Y. Hasegawa*).

Locality.—Honsyu, Japan.

This species is characteristic in the structure of 15-segmented antennæ, the reduction of radial and median forks of wing veins and the shape of subgenital plate.

PSYCHODA Jp-No. 2.

A medium-sized pale brownish gray species, somewhat allied to *Psychoda crassipenis* Tonnoir, but the present specimen with distal segments of both antennæ broken off and the male unknown.

Female.—Body, about 1.5 mm long. Wings, about 1.16 by 0.44 mm. Head with eyes separated above as wide as a facet from each other, with four segments of maxillary palpi in proportion of 17:21:23:25. Distal segments of antennæ broken. Fore and hind legs with segments excepting coxæ and trochanters in relative length of 74:78:34:15:12:11:14 and 85:115:45:18:14:11:14 respectively. Wings with R_1 ending above tip of Cu_1, both forks complete and radial fork beyond median fork, relative lengths of R_{2+3}, R_2 and R_3 about 28:22:34 and those of $_{1+2}$ and M_2 about 22:47. Subgenital plate (Fig. 63) shorter than basal width (32:52), somewhat trapezoid, setigerous, narrowed pre-apically, with caudal lobes very short, round at tips and very widely separated by a broad and shallow lunate caudal incision; inner rod stout, rather short, about thrice as long as wide and ending before caudal margin of subgenital plate; spermathecæ (Fig. 64) with a pair of subsquare plates which are thickened along caudal margins; ovipositor far longer than subgenital plate (54:32).

Male.—Unknown.

Specimen.—Female; Matsuyama, Ehime Prefecture; November 22, 1948 (*M. Miyatake*).

Locality.—Shikoku, Japan.

PSYCHODA Jp-No. 3.

A pale brownish gray medium-sized species. The male sex is not known and the female specimen is not complete, the distal antennal segments being broken.

Female.—Body, about 1.79 mm long. Wings, about 1.73 by 0.75 mm. General structure closely similar to that of *Psychoda motoharui* Tokunaga et Etsuko, but wings not provided with complete radial fork, bases of R_3 broadly atrophied or highly reduced. Head with eyes separated above from each other less than a facet. Maxillary palpi with four segments in proportion of 23:23:25:35. Antennæ with ascoids normal and Y-shaped. Legs with segments excepting basal two about 94:103:36:19:14:12:15 in fore, 96:134:49:21:15:12:15 in middle and 112:158:48:20:16:13:18 in hind leg. Wings with R_1 ending slightly or just before tip of M_4, relative lengths of R_{2+3}, R_2 and R_3 about 45.5:37:31 to 47, those of M_{1+2} and M_2 about 37:62.5. Subgenital plate (Fig. 65) closely as in *P. motoharui*, its basal broad area semicircular, caudal lobes widely divergent caudad and round at tips; inner rod small, cylindrical about thrice as long as wide; spermathecæ (Fig. 66) with a pair of somewhat inverted K-shaped framework and reticulation on surface; ovipositor rather short and about 1.15 times as long as subgenital plate (60:52).

Male.—Unknown.

Specimen.—A female; Matsuyama, Ehime Prefecture; October 31, 1951 (*M. Tokunaga*).

Locality.—Shikoku, Japan.

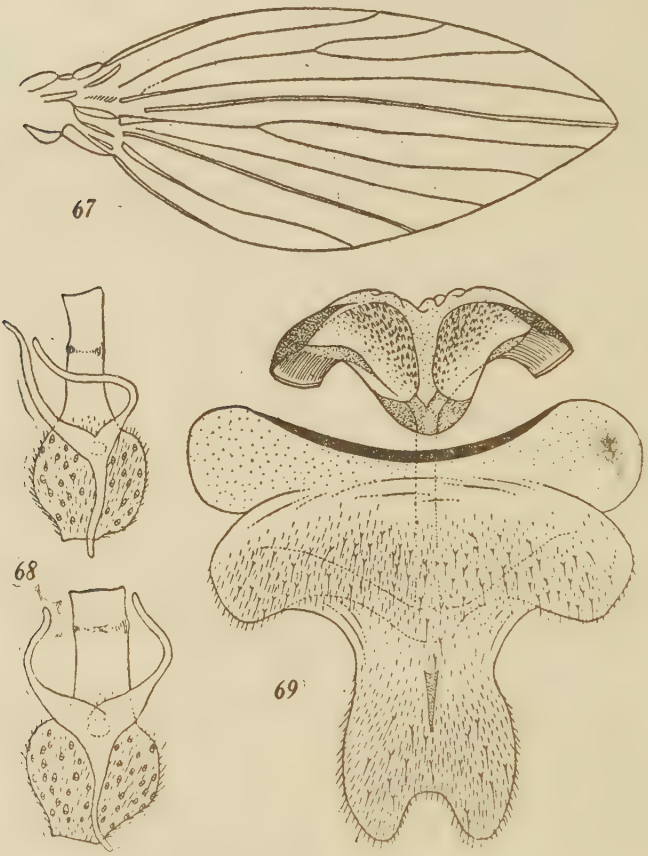
This species is closely allied to *Psychoda motoharui* Tokunaga et Etsuko, but the present species is quite different in the wing venation and structure of the spermathecæ.

PSYCHODA Jp-No. 4.

A single female sex which is incomplete for indentification, the distal segments of all antennæ being broken.

Female.—Body, brownish gray and length about 2.73 mm. Wings, about 2.86 by 1.21 mm. Head with eyes rather broadly separated above as wide as two facets, without eye-bridge.

Antennæ with ascoids all well developed, Y-shaped, bases of anterior arms of ascoids distinctly swollen on basal segments and slightly so on distal segments (Fig. 68); relative lengths of basal four segments about 27:20:33:35. Maxillary palpi with four segments in proportion of 27:32:31:48. Wings (Fig. 67) with R_1 ending beyond tip of Cu_1, both forks complete, radial



***Psychoda* Jp–No. 4. (Female).**

FIG. 67. Wing; 68, two flagellar segments of antenna; 69, subgenital plate with spermathecæ.

fork distinctly beyond median fork, relative lengths of R_{2+3}, R_2 and R_3 about 76:58:88 and those of M_{1+2} and M_2 about 57:111. Subgenital plate and sternite (Fig. 69) broadly fused with each other; basal sternal part transverse and setigerous; distal part slightly setigerous, narrowed basally, its lateral sides

slightly convex, longer than wide, with caudal median incision U-shaped and paired caudal lobes short and round at tips; inner rod conical, rather long, arising from basal part of subgenital plate and ending far before caudal incision; spermathecæ with reticulation on surface; ovipositor about 1.3 times as long as subgenital plate and sternite taken together (95:67).

Male.—Unknown.

Specimens.—A female; Shimoda, Izu; March 25, 1949 (*N. Fukuhara*). A female; Mt. Ari, Formosa; December 27, 1934 (*M. Tokunaga*).

Locality—Japan (Honsyu) and Formosa.

The above description is mainly based on a Japanese spicemen.

Formosan specimen is smaller than Japanese, the wings measuring 2.03 by 0.79 mm.

NEW OR LITTLE-KNOWN TIPULIDÆ FROM EASTERN ASIA (DIPTERA), XLV

By Charles P. Alexander
Amherst, Massachusetts

FOUR PLATES

The first part under this general title was published in 1926, the last (No. XLIV) in 1941.[1] This series of reports include descriptions of more than one thousand new species of crane-flies, virtually all with figures showing venation and the structure of the male genitalia. Part XLIV is almost unobtainable and is one of the scarcest of the more than 750 papers on the Tipulidæ that have been published by the writer. This rarity was occasioned by the invasion of the Philippines by the Japanese during the Second World War, with the resultant partial destruction of Manila, when copies of this particular issue of the Philippine Journal of Science, together with all reprints of the article, were destroyed.

I am now planning to revive this series of papers to include descriptions of crane-flies in the vastly rich fauna of the Oriental-Australasian regions. I expect to describe and figure not only the various novelties involved but also to characterize briefly and to figure essential structures of species that have been described elsewhere by the writer and by other authors but which have never been illustrated. This idea has been furthered by recent losses of important insect collections in various parts of the world, the most recent being the partial destruction in November 1956 of the collections of the Hungarian National Museum in Budapest. Reports indicate that while portions of this great collection were saved virtually all the Diptera were destroyed, these totalling about 250,000 specimens and including the types of approximately 1,000 species. It has become very necessary that new species of insects be adequately described and especially that figures of critical structures be provided, in order to validate a given species in the event of loss of the physical specimens.

[1] Alexander, C. P. New or little-known Tipulidæ from Eastern Asia (Diptera), Part I. Philip. Jour. Sci. 31 (1926) 363-383, *2 pls;* New or little-known Tipulidæ from Eastern Asia (Diptera), Part XLIV. Philip. Jour. Sci. 76 (1941) 27-66, *4 pls.*

In the present report I am considering species derived from two sources, one being based on extensive collections made in Ceylon in 1954 by Dr. Fernand Schmid, of Lausanne, Switzerland, the second series from Nepal, having been taken by Dr. Edward I. Coher, now medical officer with the World Health Organization in that country. Both collections are exceedingly rich in species and both have added materially to our previous knowledge of the crane-flies of these two countries. I wish to express my gratitude to Doctors Coher and Schmid for these collections, the types of the novelties and other specimens being preserved in my extensive series of these flies.

Nepal, in particular, had remained inaccessible and virtually unknown until very recent years due to restrictions on travel by foreigners imposed by the then ruling house of Rana. It is certain that further surprising discoveries will be made in this rugged 500 mile long section of the Himalayas. As I have indicated in another paper, most of the species so far discovered in eastern Nepal, in the general vicinity of Katmandu (Kathmandu) have proved to be distinct from those taken at Darjeeling (Darjiling) in extreme northern Bengal, India, as described and discussed by the late Enrico Brunetti, chiefly between 1911 and 1918. The information at present available appears to indicate that there is an actual marked difference in composition of the two faunas, despite the fact that they are separated by a distance of less than 200 miles. However some of this distinctness may be apparent rather than real since the present materials from Nepal, upon which this opinion is based, were taken chiefly in October, representing the autumnal fauna, whereas the majority of the crane-flies known from the Darjeeling district are spring and early summer forms. Some readily available references to Nepal are cited.[2]

[2] BLACKER, L.V.S. The aërial conquest of Everest. Nat. Geog. Mag. 64 (1933) 127-162, ill.

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WHITE, JOHN CLAUDE. Nepal: a little-known kingdom. Nat. Geog. Mag. 38 (1920) 245–283, ill.

TIPULINÆ

LONGURIO (LONGURIO) ZEYLANICA sp. nov.

Size medium (wing of male 10.5 mm); mesonotum yellow, præscutum with three brown stripes on posterior half; knobs of halteres infuscated; legs light yellow, the tips of the femora and tibiae narrowly darkened; wings grayish, stigma slightly darker; Rs subequal to R_{2+3}; cell M_1 short-petiolate; m-cu short; cell 2nd narrow; abdomen yellow, posterior borders of segments dark brown.

Male.—Length, about 9 millimeters; wing, 10.5.

Frontal prolongation of head above brownish yellow, yellow beneath; nasus represented by two seperate small tubercles, as in errans. Antennae with scape pale and pruinose, above, darker beneath; pedicel obscure yellow; flagellum broken. Anterior vertex narrow, about twice the diameter of scape, light silvery; posterior vertex obscure yellow.

Pronotal scutellum light yellow. Mesonotal præscutum polished yellow, on posterior half with three brown stripes, the lateral pair darker, the pale central vitta ending before the suture; lateral praescutal borders pale yellow; scutal lobes extensively dark brown, the central region yellow; scutellum testaceous yellow; mediotergite yellow, vaguely more darkened laterally and behind. Pleura and pleurotergite, with the dorsopleural region pale yellow. Halteres with stem pale, knob infuscated. Legs with coxae and trochanters pale yellow; femora light yellow, the tips very narrowly and abruptly brownish black; tibiæ yellow, tips more narrowly infuscated; tarsi brownish yellow, the outer segments only a little darker. Wings grayish, prearcular region paler; stigma small, pale brown, ill-delimited; veins brown. Veins beyond cord virtually glabrous, with a few very scattered trichia on vein R_{4+5}. Venation: Sc_1 weakly preserved; Rs subequal to R_{2+3}; r-m long, at the fork of Rs, R_{4+5} in alignment with the latter; cell M_1 deep, its petiole about one-half m; m–cu short, about one-half longer than m, shorter than the distal section of Cu_1; M_{3+4} subequal to m–cu; cell 2nd A very narrow.

Abdominal tergites yellow, the posterior borders of the segments brown, sending a central spur cephalad, isolating the ground; sternites pale yellow, the extreme posterior borders of the segments darkened; subterminal segments more uniformly darkened, the hypopygium more strongly so. Male hypopygium with the tergite transverse, its posterior border shallowly

emarginate, the low broad lateral lobes with very numerous setæ. Basistyle small. Outer distisyle a small pale oval lobe; inner style small, with a cylindrical basal lobe that is tipped with several spinelike black setæ; beak moderately long, obtuse at tip; face of body of style with an elevated black flange that is extended into about five spines.

Habitat.—Ceylon.

Holotype, male Ambawela, altitude 6,000 feet, March 4, 1954 (*Schmid*).

Quite distinct from the only other described regional species, *Longurio* (*Longurio*) *errans* (Edwards), in the coloration of the thorax and legs and, especially, in the venation. Edwards compares his fly with the New Zealand *L.* (*L.*) *pallida* (Hutton), which is quite distinct from the present fly in all details of venation. The bifid nasus likewise occurs in *errans*. It should be noted that a somewhat comparable nasus is found in a Neotropical species of *Holorusia ocellata* (Enderlein).

DOLICHOPEZA (NESOPEZA) GUTTULANALIS sp. nov. Plate 1, fig. 2; Plate 3, fig. 33.

Belongs to the *gracilis* group; mesonotum brownish yellow, præscutum with indications of darker brown stripes; femora pale yellow, tips narrowly dark brown, tarsi white; wings whitened, with a heavy brown pattern, chiefly costal in distribution, including a series of marginal spots in the Anal cells; medial forks relatively deep; male hypopygium with the posterior border of tergite emarginate, blackened, with an acute median spine; outer dististyle narrow, inner style very broad and flattened.

Male.—Length, about 9 millimeters; wing, 8.2; antenna about 3.

Female.—Length, about 10 millimeters; wing, 8.8.

Frontal prolongation of head brownish yellow; palpi dark brown. Antennæ of male relatively short, obscure yellow; flagellar segments long-cylindrical, with a dense erect pubescence and single unilaterally arranged verticils. Head light brown; anterior vertex of male about twice the diameter of scape.

Pronotum brown. Mesonotum chiefly light brownish yellow, præscutum with indications of a slightly darker brown stripe. Pleura with the mesepisternum slightly darker brown than the more yellowed mesepimeron (pteropleurite). Halteres with stem dirty white, clearer at base, knob dark brown. Legs with

fore coxæ weakly darkened, remaining coxæ pale, the middle pair darkened on basal half; trochanters whitened; femora pale yellow, tips narrowly dark brown; tibiæ pale yellow, tips not or very narrowly darkened; tarsi white. Wings (Plate 1, fig. 2) with the ground whitened, with a heavy brown pattern as in the *gracilis* group, including virtually all of cells C and Sc, with posterior extensions over arculus, at one-third the length of cell R, origin of Rs and the anterior cord; major interconnecting areas in distal ends of outer radial cells; brown marginal spots present, very small on the medial veins, becoming larger on Cu; in Anal field with four large spots, at ends of each vein and one in each of the cells; veins brown. Venation: Rs long, square and spurred at origin; medial forks of moderate depth, cell M_1 subequal to or about one-half longer than its petiole; m–cu about two-thirds its length before the fork of M; cell 2nd A narrow.

Abdomen bicolored, tergites chiefly dark brown, the bases of the segments pale, the second tergite chiefly darkened; outer segments, including the hypopygium, more obscured. Eighth sternite with central region very densely provided with short spinelike setæ. Male hypopygium (Plate 3, fig. 33) with the tergite small, its posterior border broadly emarginate, farther produced into an acute median point; lateral lobes heavily blackened, smooth. Basistyle, *b*, very short, extending to scarcely beyond the tergal margin. Outer dististyle, *d*, a long slender blade, broadest at near midlength, thence narrowed to the subobtuse tip, the length about five times the width; inner style large and flattened, the inner apical angle produced into a blackened beak, its tip truncate, surface unusually smooth.

Habitat.—Ceylon.

Holotype, male, Labugama, altitude 175 feet, January 7, 1954 (*Schmid*). Allotopotype, female, pinned with the type. Paratopotype, 1 female, January 8, 1954.

The most similar regional species in *Dolichopeza (Nesopeza) costalis* Brunetti, which is readily distinguished by the coloration and venation of the wings.

DOLICHOPEZA (NESOPEZA) SINGHALICA sp. nov. **Plate 1, fig. 3.**

Belongs to the *gracilis* group; general coloration of præscutum light brown, with four more brownish yellow stripes, pleura testaceous yellow; legs brownish black, outer tarsal segments snowy white; wings weakly tinged with brown, with

a very reduced darker brown pattern, including seams over the anterior cord and origin of Rs; cell M_1 moderately deep, from two to two and one-half times its petiole; abdominal tergites dark brown.

Female.—Length, about 10.5 to 11.5 millimeters; wing, 11.5 to 12; antenna, about 2.1 to 2.2.

Rostrum brownish yellow; palpi brown, passing into black. Antennæ short; scape obscure yellow, pedicel dark brown, flagellum black; flagellar segments cylindrical, subequal to the verticils, Head yellow, vaguely more darkened on orbits between the eyes.

Pronotum light brown. Mesonotal præscutum with the restricted ground very pale brown, the disk with four more brownish yellow stripes that are poorly differentiated; posterior sclerites of notum pale brown, the posterior border of the mediotergite with two circular yellowed spots; præscutal vestiture sparse, pale and weak. Pleura testaceous yellow, unpatterned. Halteres with stem yellow, knob brownish black. Legs with the coxæ and trochanters yellow; femora light brown, the tips passing into brownish black, bases more obscure yellow; tibiæ brownish black; basitarsus brownish black, the outer two-fifths and remainder of tarsi snowy white. Wings (Plate 1, fig. 3) weakly tinged with brown, with a restricted and inconspicuous darker brown pattern, including the stigma, a broad seam at origin of Rs and a narrower one over the anterior cord; prearcular field and costal border slightly darger than the ground; veins brown. Venation; Rs long, strongly angulated and conspicuously spurred at origin; anterior cord transverse; cell M_1 moderately deep, from two to two and one-half times its petiole; m–cu less than one-half times its length before the fork of M; cell 2nd A moderately broad.

Abdominal tergites brown to dark brown, sternites more yellowed; genital shield of female darkened, cerci straight.

Habitat.—Ceylon.

Holotype, female, Nuwara Eliya, altitude 6,000 feet, February 26, 1954 (*Schmid*). Paratopotype, 1 female.

Quite distinct from all other regional members of the restricted *gracilis* group in the very reduced darkened pattern of the wings. Among the described forms it somewhat suggests *Dolichopeza* (*Nesopeza*) *infuscata* Brunetti but is entirely distinct.

DOLICHOPEZA (NESOPEZA) PALIFERA sp. nov. Plate 1, fig. 1; Plate 3, fig. 34.

Belongs to the *gracilis* group; size medium (wing of male 8.5 millimeters); general coloration of thorax light brown, præscutum with vague paler stripes, pleura light yellow; legs with outer ends of tibiæ dirty white, tarsi snowy white; wings weakly tinged with brown, vaguely patterned with darker; male hypopygium with the posterior border of tergite trilobed, the central lobe a spine; mesal lobe of basistyle large, bearing about ten strong spines; eighth sternite narrowed posteriorly into a blackened chisel-like point.

Male.—Length, about 8 millimeters; wing, 8.5 antenna, about 2.

Rostrum yellow, with black setæ, those at tip longer; palpi with basal segments brown, the outer ones darker. Antennæ with scape and pedicel yellowish brown to light brown, flagellum darker; flagellar segments long-cylindrical, with a dense white pubescence and scattered verticils that are much shorter than the segments. Head obscure yellow, the sides of the posterior vertex and genæ more brownish gray.

Pronotum yellowish brown. Mesonotal præscutum almost uniform light brown or brownish yellow, with vague indications of darker stripes, evidently with the three usual stripes being paler than the interspaces; posterior sclerites of notum almost uniform light brown. Pleura and pleurotergite light yellow. Halteres with stem light brown, knob dark brown. Legs with coxæ and trochanters light yellow; femora brownish yellow, the tips passing into dark brown; tibiæ weakly darkened basally, the outer ends dirty white; tarsi snowy white. Wings (Plate 1, fig. 1) weakly tinged with brown; stigma oval, brown; very restricted to scarcely evident smaller clouds at origin of Rs and over the anterior cord; wing tip in outer radial field extensively and similarly darkened; veins brown. Venation: Rs angulated and spurred at origin; medial cells relatively shallow, cell M_1 a little longer than its petiole; m–cu a distance before fork of M about equal to one-third to one-half its own length; cell 2nd A narrow.

Abdominal segments bicolored, dark brown, just beyond the base ringed with paler; hypopygium chiefly yellowed, tergite and styli darkened. Male hypopygium (Plate 3, fig. 34) with the eighth sternite, *8 s*, pale, narrowed posteriorly, terminating in a blackened truncated lobe that suggests a chisel in outline.

Ninth tergite, *9 t*, transverse, the posterior border conspicuously emarginate, with a small median spine; lateral lobes large, smooth heavily blackened. Basistyle, *b*, with mesal lobe very large, outer margin produced into smaller lobules that bear strong flattened spines, some ten or eleven in number. Outer distisyle, *d*, small, with relatively few setæ; inner style large, the base broad, the darkened apex more dilated, on a microscopic appearing subcapitate, surface densely covered with setulæ.

Habitat.—Ceylon.

Holotype, male, Dela, altitude 200 feet, February 18, 1954 (*Schmid*). Paratype, 1 male, Kitulgala, altitude 800 feet, March 3, 1954 (*Schmid*).

Dolichopeza (Nesopeza) palifera is quite distinct from all other described regional species. Among these it is closest to *D. (N.) singhalica* sp. nov., differing in the coloration of the body, legs and wings.

CYLINDROTOMINÆ

CYLINDROTOMA NIGRITARSIS Alexander. **Plate 1, fig. 4.**

Cylindrotoma nigritarsis ALEXANDER, Journ. N. Y. Ent. Soc. (in press).

Type, Simbhanjang Pass, Nepal, altitude 8,190 feet, October 1, 1956 (*Coher*).

Sex, probably female.—Length, about 7.5 millimeters; wing, 8.

General coloration yellow, patterned with blackish gray, including a solid shield on the præscutum; antennæ black, scape and pedicel yellow; tibiæ and tarsi black; wings (Plate 1, fig. 4) with a brownish tinge, restrictedly patterned with darker brown at origin of Rs and along cord.

LIMONIINÆ

LECHRIINI

LECHRIA ARGENTOSIGNA sp. nov. **Plate 1, fig. 5.**

General coloration black; eyes of female broadly holoptic; halteres with dark brown knobs; femora yellowish brown, tips blackened, tibiæ and tarsi black; wings weakly tinged with gray prearcular and costal fields more yellowed, veins brown m–cu about its own length beyand the fork of M; first abdominal tergite gray, succeeding segments brownish yellow, the pleural membrane of segments one to five, inclusive, each with

a large silvery area; cerci of ovipositor provided with strong erect setæ.

Female.—Length, about 5.5 to 5.7 millimeters; wing, 6.3 to 6.5.

Rostrum and palpi black. Antennæ short, black, scape paler; flagellar segments small, short-cylindrical, with short verticils; terminal segment about one-third longer than the penultimate. Head dull black; eyes very large, very broadly holoptic.

Prothorax dull black. Mesonotal præscutum and scutal lobes polished black, midregion of scutum narrowly pruinose; scutellum and postnotum black, opaque by a gray pruinosity. Pleura chiefly polished black, including the mesepisternum, the propleura pale, pruinose; mesepimeron darker, silvery pruinose. Halteres with stem obscure yellow, brighter basally, knob dark brown. Legs with all coxæ and trochanters obscure yellow; femora yellowish brown, tips blackened; tibiæ and tarsi black. Wings (Plate 1, fig. 5) weakly tinged with gray, prearcular and costal fields more yellowed; veins brown, more yellowed in the brightened fields. Venation: Sc relatively short, ending slightly beyond the fork of Rs; m-cu about its own length beyond the fork of M. the second section of M_{3+4} longer than M_4.

First abdominal tergite gray pruinose, succeeding segments brownish yellow, the subterminal segments a little darker; pleural membrane dark brown, with large silvery areas on segments one to five, inclusive; genital segment obscure yellow. Ovipositor with cerci relatively short, strongly upcurved, provided with strong erect setæ throughout their length.

Habitat.—Nepal.

Holotype, female, Amlekhgang, altitude 1,690 feet, August 20, 1956 (*Coher*). Paratopotype, 1 female, August 30, 1956.

Lechria argentosigna is allied to *L. argyrospila* Alexander, of South India, differing in slight details of coloration and venation, as the position of m–cu.

LIMONIINI

LIMONIA (LIMONIA) ILLUMINA sp. nov. **Plate 1, fig. 6; Plate 3. fig. 36.**

Size medium (wing, 7 milimeters or more); general coloration dark brown to brownish black; wings strongly suffused with blackish, slightly patterned with darker; Sc_1 ending opposite one-fifth to one-third the length of Rs; male hypopygium with two widely separated rostral spines; mesal lobe of gonapophysis very long and slender.

Male.—Length, about 6.5 millimeters; wing, 7.

Female.—Length, about 7 millimeters; wing, 7.5.

Rostrum and palpi brownish black. Antennæ black throughout; flagellar segments subcylindrical, subequal to the longest verticils. Head dark brown, surface opaque.

Pronotum dark brown. Mesonotum almost uniformly dark brown or brownish black, surface opaque, humeral region of præscutum vaguely paler. Pleura dark brown. Halteres of normal length, dark brown, base of stem restrictedly paler. Legs with coxæ testaceous, fore pair darker; trochanters obscure yellow; remainder of legs brownish black to black. Wings (Plate 1, fig. 6) strongly suffused with blackish, stigma oval, still darker; narrow and vague darkened seams at origin of Rs, cord and outer end of cell of 1st M_2; veins brown. Venation: Sc variable in length, ending from about one-fifth to shortly beyond one-third the length of Rs. Sc_2 a short distance from tip of Sc_1; cell 1st M_2 longer than vein M_4; m-cu at or close to fork of M.

Abdomen, including hypopygium, brownish black. Male hypopygium (Plate 3, fig. 36) with the tergite, *t*, transverse, gently narrowed outwardly, the posterior lateral angles produced into relatively small stout darkened lobes; setæ virtually restricted to the lobes and lateral borders, with a single pair of bristles at the midline; proctiger conspicuous, appearing as membrane that is densely set with setulæ, forming a pattern of two subparallel darkened lines. Basistyle, *b*, with the ventromesal lobe large, simple, on lower face with some setæ of unusual length. Dorsal dististyle a relatively small curved sickle, the tip acute. Ventral dististyle, d, slightly exceeding the basistyle in area, fleshy, with an accessory fleshy lobe on face between the dorsal style and the rostrum; rostral prolongation stout, tip short, obtuse; two widely separated rostral spines, the outer one from a short basal tubercle, the inner spine more basal in position, lying in membrane, arising from a long slender basal tubercle. Gonapophysis, *g*, with mesal-apical lobe very long and slender.

Habitat.—Nepal.

Holotype, male, Simbhanjang Pass, altitude 8,190 feet, October 1, 1956 (*Coher*). Allotopotype, female, pinned with type. Paratopotype, 1 female; paratype, 1 male, Sleepy Hollow, altitude 7,900 feet, December, 1956 (*Coher*).

This fly is quite distinct from other black-winged regional members of the genus in its general coloration, venation, and structure of the male hypopygium. It somewhat suggests *Limonia (Limonia) thanatos* Alexander yet is quite distinct.

LIMONIA (DISCOBOLA) EUTHENIA sp. nov. **Plate 1, fig. 7; Plate 3, fig. 35.**

Size medium (wing of male about 10 millimeters); femora brown, ringed with yellow; wings yellow, the costal interspaces strongly saturated yellow; a heavy brown pattern, including larger areas in the costal field and numerous brown dots in various cells; male hypopygium with the tergal lobes conspicuous, separated by a broad notch; body of the gonapophysis narrower than the mesal-apical lobe.

Male.—Length, about 8 to 8.5 millimeters; wing, 10 to 10.5.

Rostrum and palpi black. Antennæ brownish black, scape slightly more pruinose; flagellar segments well-separated by short glabrous apical pedicels, a little longer than their verticils. Head brownish black behind, the front and anterior vertex silvery, the latter relatively narrow, elevated.

Pronotum obscure yellow above, darkened on the sides. Mesonotal præscutum with the disk almost covered by three brown stripes that are opaque by a gray pruinosity, the humeral and anterior parts yellowed; lateral præscutal border before the suture smooth and darkened; posterior sclerites of notum dark brown, the restricted midregion of scutum, scutellum and central part of mediotergite gray pruinose; pleurotergite and sides of mediotergite dark brown. Pleura with dorsal half dark brown, the ventral part, including the sternopleurite, meron and metapleura obscure yellow. Halteres brownish black, the extreme base of stem yellow. Legs with coxæ brownish yellow, the fore pair darker, trochanters obscure yellow; femora chiefly brown to dark brown, the bases restrictedly brownish yellow, the narrow tip and a slightly broader subterminal ring yellow; tibiæ and tarsi brown, outer trasal segments darker. Wings (Plate 1, fig. 7) with the ground yellow, the costal interspaces more saturated yellow; a heavy dark pattern, including larger areas in costal field, placed at the base, postarcular region, origin of Rs, fork of Sc and stigma, in cases the areas solid, in others with small yellow centers comparable but solid areas at end of vein R_3 and along posterior margin in cells M, Cu and the Anals; other more ocelliform areas at fork of Rs, cord and outer end of cell 1st M_2; cells of central half of wing,

especially before cord and in cell R_5, with smaller brown dots; veins yellow, brown to brownish black in the patterned parts. Venation: R_{1+2} elongate; cell 1st M_2 long, exceeding in length any of the veins beyond it.

Abdomen with the basal segments extensively obscure yellow, restrictedly patterned with brown, especially on sides and the narrow posterior borders of the sternites; outer segments, including the hypopygium, chiefly dark brown. Male hypopygium (Plate 3, fig. 35) with the tergite, *t*, transverse, lobes conspicuous, narrower than the median notch, with abundant strong setæ. Basistyle, *b*, with its ventromesal lobe stout, the setæ restricted to apex and lower face. Dorsal dististyle a very gently curved black rod that narrows gradually into a long spine. Ventral dististyle, *d*, long and narrow, nearly as long as the basistyle but more slender; rostral prolongation slender, spines two, placed on basal half of outer face. Gonapophysis, *g*, with the mesal-apical lobe slender, gently curved, the body of the apophysis even narrower.

Habitat.—Nepal.

Holotype, male, Simbhanjang Pass, altitude 8,190 feet, October 1, 1956 (*Coher*). Paratopotype, 1 male.

The most similar regional species is *Limonia (Discobola) armorica* Alexander, described from northeastern Burma and based on a manuscript name earlier suggested by Edwards. The description given by the writer [Rec. Indian Mus. **44** (1942) 54] is sufficient. This fly is larger than the present species, with the wing pattern quite distinct. The male hypopygia of the two flies are of the same general structure yet differ in the details.

LIMONIA (DISCOBOLA) ANNULATA (Linnæus).

Tipula annulata LINNÆUS, Syst. Nat., Ed. 10 (1758) 586.
Limnobia argus SAY, Long's Exped. to St. Peter's R., 2, Appendix (1824) 358.
Limonia (*Discobola*) *annulata* ALEXANDER, Dipt. Conn. 1 (1942) 309–310.

Nepal: Sleepy Hollow, altitude 7,900 feet, October 1, 1956 (*Coher.*)

The present fly is one of the most widely distributed Tipulidæ in the world, occurring throughout the Holarctic region,

and extending far to the south in the Oriental and Australasian regions. I had earlier reported the species with some question from the Khasi Hills, Assam [Rec. Indian Mus. 44 (1942) 53–54] and this determination is now confirmed.

LIMONIA (DICRANOMYIA) LAKSHMI sp. nov. **Plate 1, fig. 8; Plate 3, fig. 37.**

Belongs to the *morio* group; size large (wing millimeters or more); general coloration of præscutum black, the lateral margins broadly fulvous; anterior vertex silvery; wings narrow, light brown, stigma darker; male hypopygium with the tergal lobes stout; ninth sternity with setæ lateral in position; ventral dististyle with a single rostral spine.

Male.—Length, about 7.5 to 8 millimeters; wing, 8.5 to 10.

Female.—Length, about 8 to 8.5 millimeters; wing, 8 to 8.5.

Rostrum yellow; palpi black. Antennæ black; flagellar segments oval, with short abrupt apical necks; verticils longer than the segments. Anterior vertex broad, bright silvery; posterior part of head blackened.

Pronotum light brown, pruinose. Mesonotal præscutum with the disk covered by three confluent black stripes, surface subopaque, humeral and lateral borders broadly fulvous; scutal lobes similarly blackened, median region brown; scutellum pale, heavily pruinose; postnotum reddish brown to black, pruinose. Pleura chiefly reddish brown, darker dorsally, forming a more or less distinct stripe; dorsopleural membrane chiefly pale. Halteres very long and slender, stem brown, knob darker. Legs with coxæ and trochanters yellow, fore coxæ slightly darker; femora brown, brighter basally, passing into black at tips; tibiæ brown; tarsi passing into brownish black. Wings (Plate 1, fig. 8) narrow, with a long basal petiole, strongly tinged with light brown, stigma darker brown; veins brown. Venation: Sc_1 ending approximately opposite to just beyond the origin of Rs, Sc_2 apparently lacking or else very far retracted; free tip of Sc_2 and R_2 in transverse alignment; cell 1st M_2 rectangular, about as long as the distal section of M_{1+2}; m–cu shortly before the fork of M.

Abdomen black, basal sternites and parts of the hypopygium paler. Male hypopygium (Plate 3, fig. 37) with the tergite transverse, narrowed outwardly, the posterior border produced into two lobes that are separated by a broad shallow notch; setæ long and conspicuous, virtually confined to the lobes. Ninth sternite, *9s*, large, with six very large and powerful setæ

on each lateral margin, tip truncated. Basistyle with ventromesal lobe stout, very obtuse at tip. Dorsal dististyle a nearly straight pale rod, gently curved and blackened on outer third, tip acute. Ventral dististyle, *d*, small, pale, its area less than that of the basistyle; rostral prolongation slender; a single stout pale rostral spine, placed at base of prolongation. Gonapophysis with mesal-apical lobe straight, narrowed to the subacute tip. Ædeagus broad, tip large, simple; sides at base with abundant short setulæ.

Habitat.—Nepal.

Holotype, male, Simbhanjang Pass, altitude 8,190 feet, November 2, 1956 (*Coher*). Allotopotype, female, with the type. Paratopotypes, 12 males and females, all in poor condition.

The other species of the *morio* group that do not have the mesonotum polished black include *Limonia (Dicranomyia) kongosana* Alexander, of the eastern Palaearctic, and *L. (D.) spinifera* (Alexander), of the eastern Nearctic region. These are readily told from the present fly by the details of coloration and the structure of the male hypopygium. In both of the species named, the elongate setæ of the ninth sternite are arranged in a close central group instead of being lateral in position, as in the present fly.

LIMONIA (PSEUDOGLOCHINA) PERISCELIS sp. nov. **Plate 1, fig. 9.**

Mesonotum brown, darker behind, with a narrow silvery central vitta extending from the suture to the abdomen, prothorax, pleura and adjoining part of pleurotergite abruptly light yellow; tibia white, with a single narrow black ring at and just beyond midlength; wings weakly tinged with darker, stigma oval, darker brown; cell 2nd M_2 moderately deep, a little over twice its petiole.

Male.—Length, about 4.5 millimeters; wing, 5.

Rostrum reduced, darkened; palpi brownish black. Antennæ brownish black throughout; flagellar segments oval, narrowed and glabrous at both ends, the enlarged central part with verticils, the longest subequal to or slightly exceeding the segment; terminal segment larger and about one-third longer than the penultimate. Front orange-yellow, posterior part of head light brown.

Prothorax and virtually all of mesopleura light yellow, with a sparse whitish bloom. Mesonotal præscutum brown, the sides slightly darker; posterior sclerites of notum darker fluid.

brown, with a narrow pale silvery stripe extending from the suture virtually to the abdomen; dorsal third of pleurotergite darkened, the ventral part yellow, like the pleura; ventral sternopleurite narrowly dark brown. Halteres with stem obscure, knob dark brown. Legs with coxæ pale; trochanters yellowish brown; femora pale yellow, the extreme base and broad tip blackened, the latter including about the outer sixth of the segment; tibia snowy white with a narrow black ring at and just beyond midlength; tarsi white. Wings (Plate 1, fig. 9) weakly tinged with darker; stigma oval, dark brown; veins brown. Venation: Sc_1 ending just beyond origin of Rs, Sc_2 shortly before this origin; cell 2nd M_2 moderately deep, a little over twice its petiole; m–cu just before the fork of M; cell 2nd A narrow, the proximal third lying close to the margin.

Abdominal tergites brown, sternites paler; subterminal segments and basistyles of hypopygium yellow, dististyles darkened.

Habitat.—Nepal.

Holotype, male, Amlekhgang, altitude 1,690 feet, September 19, 1956 (*Coher*).

Both of the other regional species, *Limonia (Pseudoglochina) bicinctipes* (Brunetti) and *L. (P.) pictipes* (Brunetti) are readily told from the present fly by having two darkened rings on the tibiæ.

LIMONIA (THRYPTICOMYIA) UNISETOSA NIGRIBASIS subsp. nov.

Characters as in the typical form, differing chiefly in the marked increase in black color on proximal ends of the basitarsi, including approximately one-third to one-fourth the segment.

Habitat.—Nepal.

Holotype, male, Amlekhgang, altitude 1,690 feet, December 5, 1956 (*Coher & Joshi*). Allotopotype, female. Paratopotype, broken, sex unknown. "Hanging on spiders web."

The typical subspecies is known from Japan and Formosa. The habit of resting on spider webs and threads is probably universal in the subgenus since it has been recorded for several species ranging from Africa to Australia.

ANTOCHA (ORIMARGULA) SALIKENSIS sp. nov. **Plate 1, fig. 10.**

Size small (wing 4 millimeters or less); general coloration of thorax dark brown and obscure yellow; antennæ of male

very long, exceeding the body or wing; flagellar segments slightly constricted before midlength, provided with very long outspreading pale setæ.

Male.—Length, about 3 millimeters; wing, 3.4 to 3.7; antenna, about 3.8 to 4.

Female.—Length, about 3.2 to 3.3 millimeters; wing, 3.8 to 4.

Rostrum brownish yellow; palpi dark brown. Antennæ of male very long, exceeding the wing; scape and pedicel yellow, flagellum dark brown; flagellar segments very long-subcylindrical, each segment slightly constricted at near one-third its length or just beyond the base, the expanded parts with very long outspreading pale setæ that are approximately as long as or longer than the segments; other vestiture of segments consists of abundant microscopic setulæ. Antennæ of female shorter but still longer than usual. Head brownish gray; eyes large.

Pronotum hidden between the head and mesothorax. Mesonotal præscutum with the disk chiefly covered by three confluent brown stripes, the humeral and lateral parts yellowed; scutal lobes dark brown; central area of scutum, scutellum and anterior two-thirds of mediotergite obscure yellow or brownish yellow, the posterior part of last darkened. Pleura chiefly dark brown, pleurotergite yellowed. Halteres infuscated. Legs with coxæ and trochanters testaceous yellow; remainder of legs light brown to darker brown, tarsi paler; claws small, simple. Wings (Plate 1, fig. 10) whitish subhyaline; veins light brown. Macrotrichia of veins long and conspicuous, relatively abundant on veins beyond cord, including the outer half of R_3 and all but the base of outer section of R_{4+5}. Venation: Rs gently convex, a little shorter than the concave basal section of R_{4+5}; R_{2+3} subequal to R_2; m-cu more than its length before the fork of M, in cases to about one and one-half or one and three-quarters its own length.

Abdomen of male brown to dark brown, in cases more yellowed, especially in the female; hypopygium obscure yellow. Male hypopygium with two dististyles, one slightly longer than the other.

Habitat.—Ceylon.

Holotype, male, Beliul Oya, altitude 2,000 feet, February 20, 1954 (*Schmid*). Allotopotype, female, pinned with type. Paratopotypes, 8 males and females; paratypes, 1 male, 1

female, Kandy, altitude 2,000 feet, January 14, 1954; 2 males, Carney, altitude 900 feet, February 2, 1954; 8 females, Kitulgala, altitude 800 feet, January 28, 1954; 7 males and females, Niriella, altitude 700 feet, February 3 and March 11, 1954 (*Schmid*).

The specific name is from *Salika,* the designation for Ceylon as used by Ptolemy and others. This fly, together with *Antocha (Orimargula) gracilicornis* (Edwards), of Sumatra, represents the extreme in antennal development so far recorded in the genus. Various other species of *Orimargula* have the antennæ of the male elongate, in cases being equal to the body, such flies including *A. (O.) brevivena* (Edwards), *A. (O.) gracilipes* (Alexander), *A. (O.) intermedia* (Edwards), and others. The present fly differs from *gracilicornis* in the coloration of the head and thorax, and in other regards. Edwards describes the male hypopygium of *gracilicornis* as having a single short sickle-shaped dististyle, subterminal in position.

PEDICIINI

NIPPONOMYIA JOSHII Alexander. **Plate 1, fig. 11.**

Nipponomyia joshii ALEXANDER, Journ. N. Y. Ent. Soc. (in press).

Type, female, Simbhanjang Pass, Nepal, altitude 8,190 feet, October 1, 1956 (*Coher & Joshi*).

Female.—Length, about 15 millimeters; wing, 13.

Size relatively large (wing of female 13 millimeters); mesonotal præscutum with the dark pattern reduced to four very small spots; legs yellow, outer tarsal segments darkened; wings (Plate 1, fig. 11) tinged with yellow, with the characteristic *Nipponomyia* pattern; cell C with subtransverse darkened lines; crossvein m oblique in position.

The species was dedicated to Mr. Gobinda P. Joshi, colleague of Dr. Coher in the World Health Organization program for Nepal.

DICRANOTA (EUDICRANOTA) DIONE Alexander. **Plate 1, fig. 12.**

Dicranota (Eudicranota) dione ALEXANDER, Journ. N. Y. Ent. Soc. (in press).

Type, female, Simbhanjang Range, Nepal, altitude 8,190 feet, October 1, 1956 (*Coher*).

Female.—Length, about 9 millimeters; wing, 9.

General coloration of notum brownish gray, præscutum with three pale brown stripes, postnotal mediotergite darkened, pleura and pleurotergite abruptly white; halteres and legs

white; wings (Plate 1, fig. 12) whitish subhyaline, with a conspicuous dark brown chiefly costal pattern; a supernumerary crossvein in cell R_1 but none in other cells of wing.

ULA (ULA) SUBBIDENS sp. nov. **Plate 1, fig. 13.**

Close to *bidens;* general coloration of thoracic dorsum dark brown, the præscutum darker anteriorly; posterior sclerites of pleura yellowed; wings strongly tinged with brown, the stigma and a cloud over the anterior cord darker; vein R_2 only about one-half as long as R_{1+2}.

Female.—Length, about 5 millimeters; wing, 5.5.

Head dark brown. Antennæ broken.

Thoracic dorsum almost uniformly dark brown, the surface subnitidous, the præscutum still darker medially in front; posterior sclerites of notum paler. Pleura dark brown dorsally and anteriorly, the ventral sternopleurite and posterior pleurites more yellowed. Halteres broken beyond the pale base. Legs with the coxæ and trochanters yellow; remainder of legs broken. Wings (Plate 1, fig. 13) strongly tinged with brown, darker than in *bidens,* the stigma and a cloud over the anterior cord darker brown; veins and macrotrichia darker. All cells of wing with the exception of Cu_1 and bases of R, M, Cu and the Anals, with abundant strong macrotrichia (position shown in figure by stippling). Venation: R_2 only one-half as long as R_1; in *bidens,* R_{1+2} shorter than R_2.

Abdomen dark brown. Ovipositor with the cerci dark horn-color, gently upcurved to the tips.

Habitat.—Nepal.

Holotype, female, Simbhanjang Pass, altitude 8,190 feet, October 27, 1956 (*Coher*).

The only close regional ally is *Ula (Ula) bidens* Alexander, of northeastern Burma, in the female sex best distinguished from the present fly by the coloration of the wings and the details of venation.

HEXATOMINI

PARADELPHOMYIA (OXYRHIZA) INDULCATA sp. nov.

Mesonotal præscutum with the anterior half yellow, the posterior part with three confluent brownish black stripes; antennæ apparently 16-segmented; dorsal thoracic pleurites black, ventral portions abruptly light yellow; legs yellow, tips of femora and tibiæ narrowly black; wings broad, very pale

yellow, restrictedly patterned with brown; relatively numerous macrotrichia in cells of outer sixth of wing.

Male.—Length, about 6 millimeters; wing, 5.2.

Rostrum and palpi brown. Antennæ broken shortly beyond the base but evidently 16-segmented, there being no fusion-segment; brown; basal flagellar segments subglobular to short-oval. Head brown.

Pronotum brownish yellow, more blackened in front. Mesonotal præscutum with approximately the anterior half and the sublateral portions yellow, the posterior part with three confluent brownish black stripes; lateral borders broadly dark brown; posterior sclerites of notum black, the central region of scutum behind the suture vaguely paler. Dorsal pleurites black, dorsopleural membrane brown; ventral pleurites and sternum, including the meron, metapleura and most of the sternopleurite, abruptly light yellow. Halteres with stem pale yellow, knob brownish black. Legs with fore coxæ dark brown, remaining coxæ and all trochanters light yellow; femora yellow tips narrowly and abruptly black; tibiæ yellow, tips very narrowly black; tarsi yellow, the terminal segments passing into brown. Wings broad, widest opposite termination of vein 2nd A; ground color very pale yellow, cell M a trifle darker; a restricted dark brown pattern, as follows: Arculus, origin of Rs, Sc_2, stigma, cord, outer end of cell 1st M_2 and fork of M_{1+2}; veins pale, darker in the patterned areas. Macrotrichia in outer sixth of wing, only the bases of the cells beyond the cord without macrotrichia. Venation: Rs angulated and short-spurred at origin; R_2 transverse but faint, a little longer than R_{3+4}; veins R_3 and R_4 only moderately divergent, no upcurved; cell M_1 subequal to its petiole; m–cu beyond midlength of cell 1st M_2; vein 2nd A not incurved to margin.

Abdomen with tergites brownish black, the bases pale yellow; seventh and eighth segments uniformly blackened; basal sternites pale; ninth segment yellowish brown, remainder brownish black. Male hypopygium as in the genus; inner point of outer dististyle a broad-based spine; inner style dark-colored, narrowed outwardly, its apex pale, obtuse.

Habitat.—Ceylon.

Holotype, male, Ambawela, altitude 6,000 feet, March 5, 1954 (*Schmid*).

The most similar species is *Paradelphomyia (Oxyrhiza) prayooni* Alexander, of Thailand, which has the coloration of the legs and wings much the same. The details of the male hypopygium and distribution of the macrotrichia of the wing cells indicate two closely related species.

PARADELPHOMYIA (OXYRHIZA) SUBTERMINALES sp. nov. **Plate 1, fig. 14.**

General coloration of præscutum dark brown, with four gray or yellowed stripes; antennæ 13-segmented, fusion-segment large, light yellow; femora obscure yellow, tips brownish black, tibiæ brown, extreme bases whitened; wings whitish, the cubital and anal fields darkened, prearcular field yellow; a conspicuous darker brown pattern over most of the veins; macrotrichia in cells of outer fifth of wing; vein R_2 strongly oblique, directed basad; veins R_3 and R_4 strongly upcurved at tips; cell M_1 present; abdomen black, segments five to seven, inclusive, orange-yellow.

Male.—Length, about 4.2 to 4.5 millimeters; wing, 4.7 to 5.2.

Female.—Length, about 5 millimeters; wing, 5.2.

Rostrum and palpi black. Antennæ 13-segmented; scape testaceous, pedicel orange, fusion-segment and succeeding segment of flagellum pale yellow, remaining segments black; flagellar segments elongate, shorter than the verticils. Head brownish gray; anterior vertex broad.

Pronotum brownish yellow above, dark brown on sides. Mesonotal præscutum with the restricted ground dark brown, appearing as three incomplete narrow interspaces on posterior half of sclerite, incompletely separating four discal stripes, the intermediate pair more grayish, lateral pair more yellowed; scutal lobes and scutellum brownish gray, the posterior lateral parts of scutal lobes paler; postnotum brownish black, the ventral pleurotergite pale. Pleura chiefly dark brown to brownish black, more or less lined ventrally with paler, more pruinose behind. Halteres with stem whitened, knob dark brown. Legs with coxæ yellow, the outer ends more infuscated; trochanters yellow, posterior pair darkened; femora obscure yellow, the tips conspicuously brownish black; tibiæ brown, the extreme bases white, tips narrowly darkened; tarsi light brown, passing into black; tibial spurs present. Wings (Plate 1, fig. 14) with the ground whitish, the cubital and anal fields more darkened; prearcular field yellowed; a conspicuous dark brown pattern, as follows; At h, above arculus, origin of Rs,

and at stigma, the last extensive, sending a posterior extension caudad across the radial field; cord and outer end of cell 1st M_2; other marks at tip of Sc_1, Sc_2 and fork of M_{1+2}, together with a marginal series at ends of veins, largest over vein R_4; darkened areas at ends of anal veins narrow, bordered by whitish; veins light brown, somewhat darker in the patterned areas. Cells of outer fifth of wing with conspicuous macrotrichia. Venation: Sc_1 ending before fork of Rs; vein R_2 oblique, directed strongly basad, subequal to or shorter than vein R_{3+4}; veins R_3 and R_4 strongly upcurved at tips; cell M_1 present, subequal to its petiole; m–cu oblique, about its own length beyond the fork of M; anal veins, especially 2nd A, bent strongly into the margin.

Abdominal tergites black, sternites somewhat paler; segments five to seven, inclusive, orange-yellow, forming a broad and conspicuous subterminal ring in both sexes. Male hypopygium generally as in other species of the genus, the outer apical angle of the outer dististyle with two strong spines, the inner one longer; an isolated erect spine on inner margin of style before apex.

Habitat.—Ceylon.

Holotype, male Ambawela, altitude 6,000 feet, March 4, 1954 (*Schmid*). Allotopotype, female, March 5, 1954. Paratopotype, 1 male, March 6, 1954; paratype, 1 male, Nuwara Eliya, altitude 6,000 feet, April 4, 1954 (*Schmid*).

Generally similar to species such as *Paradelphomyia (Oxyrhiza) krisna* Alexander, differing very evidently in the coloration of the abdomen and wings, and in all details of venation, as the oblique R_2 and the strongly upcurved veins R_3 and R_4.

PARADELPHOMYIA (OXYRHIZA) MANOPI Alexander.

Paradelphomyia (Oxyrhiza) manopi ALEXANDER, Ann. Mag. Nat. Hist. (12) 9 (1956) 43–45.

Described from Chiengmai Province, Thailand.

Nepal: Nayagaon, altitude 1,690 feet, August 31, 1956 (*Pratap Singh*).

POLYMERA (POLYMERA) ZEYLANICA sp. nov. **Plate 1, fig. 15.**

Size medium (wing of male about 5 millimeters); mesonotum dark brown, dorsal pleurites blackened; antennæ of male elongate, about two-thirds the wing; knobs of halteres yellowed; legs brownish yellow to light brown; wings strongly suffused with brown; stigma not or scarcely differentiated; cell

M_2 open, M_1 small but present; abdomen dark brown, including the hypopygium and all but the tips of the valves of the ovipositor.

Male.—Length, about 5 millimeters; wing, 5; antenna, about 3.8.

Female.—Length, about 6 millimeters; wing, 6.3; antenna, about 2.

Rostrum black, pruinose; palpi black. Antennæ of male elongate, as shown by the measurements; flagellar segments bicolored, dark brown, the narrowed glabrous apical necks yellow; enlarged bases with conspicuous erect setæ, the longest nearly twice the segment; in the female, antenna relatively long for this sex; scape black, pedicel light yellow, flagellum black; flagellar segments elongate but shorter than the verticils. Head gray surrounding the antennal fossæ, more brownish gray behind; anterior vertex at narrowest point with a pair of nearly contiguous velvety black spots.

Pronotal scutum brownish black, sparsely pruinose, scutellum more testaceous. Mesonotum almost uniformly dark brown, sparsely pollinose, not or scarcely patterned; pseudosutural foveæ linear, black; in the male, the lateral præscutal borders broadly paler, with a sublateral darker spot. Dorsal pleurites and pleurotergite blackened, sternopleurite paler, more yellowish brown. Halteres with stem light brown, knob paling to obscure yellow. Legs with fore coxæ infuscated, remaining coxæ and all trochanters yellow; remainder of legs brownish yellow to light brown, outer tarsal segments darker; tibial spurs conspicuous. Wings (Plate 1, fig. 15) strongly suffused with brown, the prearcular and costal fields a little more yellowed; stigma not or scarcely differentiated; a linear white line in cell R, crossing the cord into cell M_2, with a second similar line immediately behind vein 1st A; veins brown, slightly more brownish yellow in the costal region. Macrotrichia of veins numerous, of moderate length only. Venation: Sc_1 ending shortly beyond fork of Rs, Sc_2 a short distance from its tip; R_{2+3+4} less than twice the basal section of R_5; cell M_1 present, small; m–cu shortly beyond the fork of M.

Abdomen dark brown, including hypopygium and all but the tips of the valves of the ovipositor.

Habitat.—Ceylon.

Holotype, female, Ambawela, altitude 6,000 feet, March 4, 1954 (*Schmid*). Allotopotype, male. Paratypes, 1 male, 1

female, Kandy, altitude 2,000 feet, January 16, 1954 (*Schmid*).

The present fly is a typical member of the subgenus, much more so than the only other regional described species, *Polymera (Polymera) furiosa* Alexander, of South India. The two flies are most obviously distinguished from one another by the presence of cell M_1 in the present fly, lacking in *furiosa*. The type female is darker than the other specimens in the type series, especially in the extensively blackened pleura, but I believe that a single species is involved.

PSEUDOLIMNOPHILA (PSEUDOLIMNOPHILA) ZELANICA sp. nov. Plate 1, fig. 16.

General coloration of mesonotum chestnut brown, præscutum with a median capillary darker line; antennæ dark brown, verticils long; tibial spurs distinct; legs with long slender scales, additional to normal setæ; wings weakly tinged with brown; vein R_{2+3+4} very long, in cases nearly equal to Rs; cell M_1 deep.

Female.—Length, about 6.5 to 9 millimeters; wing, 6.8 to 10.

Rostrum small, testaceous yellow; palpi dark brown. Antennæ dark brown; flagellar segments elongate, the outer ones becoming very long and slender, with very long verticils, additional to shorter but still long setæ. Head brownish gray to light gray; anterior vertex narrow, about three-fourths the diameter of scape.

Pronotum brown, scutellum more brownish yellow. Mesonotal præscutum and scutum chestnut brown, the former with a more or less evident capillary darker central line, more evident in the type; scutellum brown, parascutella paler; mediotergite dark brown, slightly pruinose, the sides, with the pleurotergite, more yellowed. Pleura uniformly pale yellow; dorsopleural region a trifle darker. Halteres weakly infuscated, knob darker. Legs with coxæ, and trochanters brownish yellow; remainder of legs pale brown the color appearing darker because of abundant scales and setæ; outer tarsal segments somewhat darker; tibial spurs long and conspicuous; segments with long narrow scales, additional to the normal setæ. Wings (Plate 1, fig. 16) weakly tinged with brown; stigma long and narrow, darker brown; veins, brown, except near wing base with conspicuous trichia. Venation: Sc long, Sc_1 ending about opposite midlength of R_{2+3+4}, Sc_2 near its tip; R_{2+3+4} of unusual length, variable, in some cases exceeding one-half Rs, in other specimens nearly as long as this vein; vein

R_4 decurved almost to wing tip; basal section of R_5 long, in longitudinal alignment with Rs, subequal to r–m; cell M_1 very deep, about three to four times its petiole; m–cu before mid-length of M_{3+4}; anterior arculus preserved, thickened.

Abdominal tergites dark brown, sternites pale yellow. Ovipositor with valves long and slender, dark brown.

Habitat.—Ceylon.

Holotype, female, Kandy, altitude 2,000 feet, January 16, 1954 (*Schmid*). Paratypes, 2 females, Nuwara Eliya, altitude 6,000 feet, February 26, 1954 (*Schmid*).

I am referring this fly to the genus *Pseudolimnophila* Alexander rather than to *Austrolimnophila* Alexander because of the strongly preserved anterior arculus but it should be emphasized that the presence of linear scales on the legs is more as in the latter genus. The discovery of the male sex should throw more light on the strict systematic position of the fly. The paratypes are much larger than the type yet unquestionably seem to be conspecific. The single most noteworthy feature of the species is the unusual length of vein R_{2+3+4} of the wings.

EUPILARIA SINGHALICA sp. nov.

Size small (wing 6 millimeters or less); mesonotum reddish brown, pleura and sternum blackened; all coxæ and trochanters light yellow; femora and tibiæ yellow, tips narrowly darkened; wings light yellow, patterned with pale brown clouds and washes, the long-oval stigma darker, preceded and followed by yellow spots; abdomen brownish black; male hypopygium with the outer dististyle slender.

Male.—Length, about 6 millimeters; wing, 5.8 to 6.

Female.—Length, about 6.5 millimeters; wing, 6.

Rostrum very small, reddish brown; palpi black. Antennæ short; basal segments yellowish brown to light brown, outer segments dark brown; flagellar segments beyond the fusion elongate, with very long verticils. Head brownish black, sparsely dusted with yellow pollen; anterior vertex very broad.

Cervical region blackened beneath, brown above. Pronotum brown. Mesonotal præscutum brown, reddish brown pollinose, without clearly defined stripes; pseudosutural foveæ blackened; posterior sclerites of notum brown, the sides of the scutal lobes and the scutellum more blackened, pleurotergite light brown. Pleura and sternum black; dorsopleural membrane buffy. Halteres with stem yellow, knob infuscated. Legs with

all coxæ and trochanters light yellow, contrasting with the black pleura; femora yellow, tips narrowly dark brown; tibiæ obscure yellow, tips more narrowly dark brown; tarsi light brown, passing into darker brown; tibial spurs distinct. Wings light brownish yellow, patterned with pale brown clouds and washes, the former at origin of Rs, cord, outer end of cell 1st M_2, and as marginal spots at ends of the more posterior veins from M to 2nd A and including the axilla; less evident dusky clouds in outer radial field; stigma long-oval, dark brown, preceded and followed by light yellow areas; veins obscure yellow, darker in the patterned areas. Venation: Vein R_3 entire; cell 1st M_2 closed; m-cu shortly beyond the fork of M.

Abdomen brownish black, the more proximal segments slightly yellowed posteriorly; hypopygium brownish black. Male hypopygium with the outer dististyle slender, narrowed outwardly, terminating in a strongly curved hook; inner style stout, blackened. Gonapophysis appearing as a slender rod, near tip suddenly narrowed into a slender spine.

Habitat.—Ceylon.

Holotype, male, Labugama, altitude 175 feet, January 7, 1954 (*Schmid*). Allotype, female, Lindula, altitude 4,100 feet, March 3, 1954. Paratopotype, broken, sex uncertain, January 8, 1954.

Most similar to *Eupilaria guttulifera* Alexander, of South India, which differs especially in the larger size and in all details of coloration of the body and legs.

EUPILARIA SINGHALICA sp. nov.

Size large (wing of male 7 millimeters or more); general coloration of mesonotum gray, patterned with light brown; pleura with a broad blackened dorsal stripe; legs brownish black, femoral bases paler; wings with a strong brown tinge, stigma small, slightly darker; tip of vein R_3 atrophied, cell M_2 open by the atrophy of m; male hypopygium with both the ædeagus and gonapophyses long and slender.

Male.—Length, about 6.5 to 7 millimeters; wing, 7 to 8.

Female.—Length, about 7 millimeters; wing, 6.2.

Rostrum short, brownish gray; palpi black. Antennæ with scape black, pruinose, pedicel more reddish brown, flagellum black; outer segments more elongate, with long verticils. Head light gray, the center of the vertex with a large brown area; anterior vertex broad.

Pronotum light gray, restrictedly infuscated above. Mesonotal præscutum light brownish gray, with four pale brown stripes; pseudosutural foveæ black, conspicuous; posterior sclerites of notum light gray; centers of scutal lobes and posterior third of mediotergite infuscated. Pleura darker gray ventrally, with a central light gray longitudinal stripe; dorsal pleurites black, forming a broad longitudinal stripe. Halteres with stem yellow, knob moderately infuscated. Legs with all coxæ and trochanters obscure yellow; remainder of legs brownish black, femoral bases paler; no evident tibial spurs. Wings with a strong brownish tinge, the prearcular and costal regions inconspicuously more yellowed; stigma small, slightly darker brown, preceded and followed by small more yellowed areas; pale longitudinal streaks in cells R and M, continued across the cord into the outer cells; veins brown. Costal fringe relatively long, posterior fringe long. Venation: Outer end of vein R_3 atrophied; cell M_2 open by atrophy of m; m–cu at or very close to fork of M.

Abdominal tergites dark brown, the posterior and lateral borders of the individual segments paler; sternites paler brown, extensively more yellowed at the incisures; hypopygium dark brown, styli paler. Male hyopygium with the outer dististyle very slender on outer half, the tip slightly curved; inner dististyle only moderately darkened, elongate, tip obtuse. Phallosome with both the ædeagus and gonapophyses long and slender.

Habitat.—Ceylon.

Holotype, male, Ambawela, altitude 6,000 feet, March 4, 1954 (*Schmid*). Allotype, female, Lauderdale, altitude 3,500 feet, February 5, 1954. Paratopotypes, males, March 4 and 5, 1954; paratype, male, Horton Plains, altitude 6,800 feet, March 7, 1954.

The specific name, *taprobane,* is the ancient Greek designation for Ceylon. The fly is readily told from all other known species, with the exception of *Eupilaria thysanotos* sp. nov., described herewith, by the venation, including the atrophied tip of vein R_3 and the open cell M_2.

EUPILARIA THYSANOTOS sp. nov. **Plate 2, fig. 17.**

Allied to *taprobanica*; general coloration of thorax yellowish gray, the præscutum with three brown stripes; wings strongly tinged with brown, stigma dark brown, conspicuous, preceded

and followed by major yellowish white areas; costal fringe of male long; tip of vein R_3 atrophied; cell M_2 open by atrophy of m.

Male.—Length, about 5.5 to 5.6 millimeters; wing, 6 to 6.2.

Rostrum black, pruinose; palpi black, terminal two segments subequal. Antennæ black, scape sparsely pruinose; base of fusion-segment obscure yellow; basal two flagellar segments united, the third less evidently so, to form a fusion-segment; succeeding segments short, about the sixth and remaining flagellar segments elongate, with very long verticils. Head light gray, the center of the vertex extensively light brown.

Pronotum brownish gray, darker brown laterally. Mesonotum with the ground yellowish gray, the disk with three conspicuous brown stripes, humeral region clearer gray; pseudosutural foveæ black, conspicuous; scutal lobes brown, the margins weakly pruinose; posterior sclerites brown, heavily light gray pruinose. Pleura gray, the dorsopleural region infuscated. Halteres with stem obscure yellow, clearer basally, knob dark brown. Legs with coxæ brown, pruinose; trochanters brownish yellow; remainder of legs dark brown; as in *taprobanica*, tibial spurs not evident. Wings (Plate 2, fig. 17) strongly tinged with brown, the outer radial field near margin slightly more darkened; prearcular and costal fields more yellowed; stigma large, dark brown, preceded and followed by large yellowish white areas; veins brown. Costal fringe of male long and conspicuous. Venation: Outer end of vein R_3 atrophied, the long basal spur with conspicuous trichia; cell M_2 open by atrophy of m.

Abdomen with segments weakly bicolored, chiefly dark brown, the bases somewhat paler, brownish yellow; sternites with the pale bases more extensive; hypopygium brownish yellow.

Habitat.—Ceylon.

Holotype, male, Kandy, altitude 2,000 feet, January, 1954 (*Schmid*). Paratopotype, male pinned with type.

The present fly obviously is related to *Eupilaria taprobanica* sp. nov., in the venation, as the atrophied tip of vein R_3 and open cell M_2, and in the lack of tibial spurs. It differs in the coloration of the body and pattern of the wings.

HEXATOMA (ERIOCERA) COHERI Alexander. **Plate 2, fig. 18.**

Hexatoma (*Eriocera*) *coheri* ALEXANDER, Journ. N.Y. Ent. Soc. (in press).

Type, male, Nagagaon, Nepal, altitude 1,690 feet, September 8, 1956 (*Coher & Joshi*).

Male.—Length, about 8 millimeters; wing, 10; antenna, about 27.

Belongs to the *lunata* group; general coloration dark; antennæ of male greatly elongated, basal segments yellow, outer flagellar segments darkened; fore and middle legs chiefly yellow, posterior tibiæ conspicuously modified, lengthened and enlarged, provided with abundant dark setæ; wings (Plate 2, fig. 18) whitish hyaline, strikingly patterned with brown, including a series of transverse lines in cell C; only two branches of M reach the wing margin.

This conspicuous and unusually distinct fly is named in honor of Dr. Edward I. Coher.

HEXATOMA (ERIOCERA) SERENDIB sp. nov. Plate 2, fig. 19.

General coloration of head and thorax brownish black, gray pruinose, præscutum without pattern; legs light brown; wings with a brownish tinge, costal border a little darker; abdomen brown, the outer segments, including the hypopygium, passing into black.

Male.—Length, about 8 millimeters; wing, 9; antenna, about 1.6.

Rostrum very short, brown; palpi brownish black. Antennæ of male apparently 7-segmented, short, as shown by the measurements, dark brown; flagellar segments progressively shorter, two and three subequal, terminal segment small. Head dark gray, with a conspicuous more blackened vertical tubercle.

Pronotum brownish gray. Mesonotum chiefly brownish black, gray pruinose; præscutum without pattern; mesonotal vestiture very short and sparse. Pleura dark brownish gray. Halteres dark brown. Legs with all coxæ dark brown, more or less pruinose; trochanters light brown; remainder of legs light brown, the outer tarsal segments somewhat darker. Wings (Plate 2, fig. 19) with a brownish tinge, the costal border a little darker; stigma not or scarcely indicated; veins pale brown. Veins beyond cord glabrous; both sections of R_5 with a continuous series of macrotrichia. Venation: Sc_1 ending about opposite r-m, Sc_1 alone shorter than R_2, the latter subequal to R_{1+2} and much longer than R ; R_{2+3+4} subequal to R_4; cell 1st M_2 rectangular, m shorter than basal section of M_3; m-cu beyond the fork of M, longer than the distal section of Cu_1.

Abdomen brown, the outer segments, including the hypopygium, brownish black to black; basal rings of segments not differentiated.

Habitat.—Ceylon.

Holotype, male, Kitulgala, altitude 800 feet, March 2, 1954 (*Schmid*).

The specific name, *serendib,* is the Arabian name for Ceylon. The species is very closely related to *Hexatoma* (*Eriocera*) *fusca* (Edwards), likewise from Ceylon, differing in the coloration of the body and legs. I have a paratype in my collection, received by exchange from Edwards.

ERIOPTERINI

GONOMYIA (ELLIPTEROIDES) THIASODES Alexander. **Plate 2, fig. 20.**

Gonomyia (*Ellipteroides*) *thiasodes* ALEXANDER, Ann. Mag. Nat. Hist. (Part 105, in press).

Type, female, Kandy, Ceylon, altitude 2,000 feet, January 10, 1954 (*Schmid*).

Female.—Length, about 5.2 millimeters; wing, 5.

General coloration polished fulvous, the vertex, anterior præscutum and anepisternum conspicuously patterned with black; halteres brown; legs obscure yellow, outer tarsal segments infuscated; wings (Plate 2, fig. 20) brownish yellow, unpatterned; cell R_3 large, veins R_3 and R_4 strongly divergent; m-cu before fork of M; cerci blackened and pointed at tips, with scattered erect setæ.

GONOMYIA (ELLIPTEROIDES) PICTILIS Alexander. **Plate 2, fig. 21; Plate 3, fig. 38.**

Gonomyia (*Ellipteroides*) *pictilis* ALEXANDER, Ann. Mag. Nat. Hist. (Part 105, in press).

Types, males and females, Nuwara Eliya, Ceylon, altitude 6,000 feet, February 26, 1954 (*Schmid*).

Male.—Length, about 6.5 millimeters; wing, 7.3.

Female.—Length, about 6.5 millimeters; wing, 7.5.

Size large (wing over 7 millimeters); general coloration of mesonotal præscutum light brown, darker behind; pleura variegated dark brown and yellow; wings (Plate 2, fig. 21) dirty white, conspicuously patterned with brown; veins R_3 and R_4 very long, cell R_2 at margin slightly more extensive than cell R_3; cell 2nd M_2 very deep; male hypopygium (Plate 3, fig. 38) with four dististyles, two glabrus, two with strong setæ.

GONOMYIA (ELLIPTEROIDES) ROHUNA Alexander. **Plate 2, fig. 22.**

Gonomyia (*Ellipteroides*) *rohuna* ALEXANDER, Ann. Mag. Nat. Hist. (Part 105, in press).

Types, females, Nuwara Eliya, Ceylon, altitude 6,000 feet, February and April, 1954 (*Schmid*).

Female.—Length, about 6 millimeters; wing, 6.

Size medium (wing of female 6 millimeters); general coloration brownish gray, disk of præscutum darker; antennæ black throughout; knob of halteres clear yellow; femora brown, tips blackened, tibiæ and tarsi black; wings (Plate 2, fig. 22) with the restricted ground obscure whitish, conspicuously patterned with brown; Sc long, veins R_3 and R_4 strongly divergent, cell R_2 at margin only one-third to one-fourth as extensive as cell R_3; vein R_3 shorter than Rs; abdomen black, pleural region with gray areas; ovipositor elongate, the tips of the cerci produced into narrow points.

GONOMYIA (IDIOCERA) PERSIMILIS Alexander. **Plate 2, fig. 23.**

Gonomyia (*Idiocera*) *persimilis* Alexander, Ann. Mag. Nat. Hist. (Part 105, in press).

Type, female, Beliul Oya, Ceylon, altitude 2,000 feet, February 20, 1954 (*Schmid*).

Female.—Length, about 6 millimeters; wing, 5. 3.

Size small (wing of female 5.3 millimeters); mesonotal præscutum and scutum brownish gray, without clearly defined pattern, ventral pleurites light yelow; antennal flagellum black; halteres with stem infuscated, knob more strongly darkened; legs yellow, tips of tibiæ and outer tarsal segments darker; wings (Plate 2, fig. 23) weakly tinged with brown, restrictedly patterned with darker; Sc_1 ending just beyond origin of Rs; abdominal tergites dark brown.

GONOMYIA (IDIOCERA) PETILIS sp. nov. **Plate 2, fig. 24; Plate 3, fig. 40.**

General coloration of mesonotum brown, præscutum with three brownish gray to gray stripes; basal segments of antennæ obscure yellow; legs obscure yellow, tips of tibiæ narrowly blackened; wings grayish yellow, prearcular and costal fields clearer yellow, stigma scarcely apparent; veins R_{1+2} and R_3 only narrowly separated at margin; male hypopygium with the outer lobe of basistyle terminating in a small point; three dististyles, two being long simple rods, the third widened outwardly, shallowly and unequally bifid near tip; phallosome unusually broad.

Male.—Length, about 4 to 4.2 millimeters; wing, 4.6 to 5.

Rostrum dark brown, more pruinose at tip. Antennæ with basal segments obscure yellow, outer segments darker; flagellar

segments oval, slightly longer than the verticils. Head light gray; setæ long, pale, chiefly proclinate.

Pronotum brownish gray, paler laterally. Mesonotal præscutum with three nearly confluent brownish gray to gray stripes, the humeral and lateral regions yellow; pseudosutural foveæ light brown; posterior sclerites of notum dark brown, parascutella yellowed. Pleura and pleurotergite reddish yellow, without clearly defined pattern. Halteres with stem yellow, knob weakly darkened, brownish yellow. Legs with coxæ and trochanters reddish brown; remainder of legs obscure yellow, tips of tibiæ narrowly but conspicuously blackened; outer tarsal segments black. Wings (Plate 2, fig. 24) grayish yellow, prearcular and costal fields clearer yellow; stigma scarcely apparent; veins very light brown, more yellowed in the brightened portions. Venation: Sc_1 ending just beyond origin of Rs, Sc_2 some distance from its tip, Sc_1 long, from two-thirds to three-fourths Rs; vein R_3 suberect, only narrowly separated from R_{1+2} at margin; vein R_4 long, arcuated, nearly twice R_{2+3+4}; cell 2nd M_2 about one-third to one-fourth longer than its petiole.

Abdominal tergites light brown, sternites more yellowed. Male hypopygium (Plate 3, fig. 40) with the outer apical lobe of the basistyle, *b*, elongate, narrowed into a small apical point or blade; inner apical lobe small but conspicuous. Three dististyles, *d;* two long and slender, simple, both terminating in acute black spines, the outer one glabrous, the innermost style with about eight strong erect setæ scattered along the stem; largest style dilated outwardly, at apex divided into two very short branches, the shorter black, the longer arm expanded, with its outer angle farther produced into a slender spine. Phallosome, *p*, unusually broad, the central part at apex, presumably representing the ædeagus, produced into a short point.

Habitat.—Nepal.

Holotype, male, Amlekhgang, altitude 1,690 feet, May 29, 1956 (*Coher*). Paratopotype, male, June 9, 1956 (*Coher*).

Readily told from all other described regional members of the subgenus by the structure of the male hypopygium, especially the dististyles and ædeagus. In its venation, it is more like species such as *Gonomyia* (*Idioccra*) *recens* (Alexander).

GONOMYIA (GONOMYIA) SERINDIBENSIS Alexander. Plate 2, fig. 25; Plate 3, fig. 39.

Gonomyia (*Gonomyia*) *serindibensis* ALEXANDER, Ann. Mag. Nat. Hist. (Part 105, in press).

Type, male, Ambawela, Ceylon, altitude 6,000 feet, March 6, 1954 (*Schmid*).

Male.—Length, about 5 millimeters; wing, 5.5.

Mesonotum brown, posterior border of scutellum broadly obscure yellow; pleura gray, conspicuously variegated with yellow; legs brownish black; wings (Plate 2, fig. 25) weakly tinged with brown, Sc short; male hypopygium (Plate 3, fig. 39) with the outer dististyle, *d*, terminating in a small acute point, inner style darkened, its outer margin bearing two powerful black spines; phallosome, *p*, with apex of ædeagus emarginate; a single blackened gonapophysis.

GONOMYIA (LIPOPHLEPS) HEDYS Alexander. **Plate 3, fig. 42.**

Gonomyia (*Lipophleps*) *hedys* ALEXANDER; Ann. Mag. Nat. Hist. (Part 105, in press).

Type, male, Deniyaya, Ceylon, altitude 1,700 feet, February 5, 1954 (*Schmid*).

Male.—Length, about 3 millimeters; wing, 3.

Allied to *flavomarginata;* mesonotum dark brown, mediotergite clearer yellow; pleura chiefly dark brown, with a broad pale yellow longitudinal stripe extending from and including the fore coxæ, attaining the base of the abdomen; wings strongly tinged with brown, variegated with paler areas before cord and elsewhere on outer half; Sc short; abdominal tergites yellow, each with a brown semicircular discal area, the outer posterior angles yellowed; male hypopygium (Plate 3, fig. 42) with the dististyles, *d*, terminal, outer style a black scabrous rod that bears a long slender spine on mesal face at base; inner style likewise produced into a long spine; phallosome, *p*, complex, including two pairs of spines.

GONOMYIA (LIPOPHLEPS) LANKA Alexander. Plate 2, fig. 26; Plate 3, fig. 41.

Gonomyia (*Lipophleps*) *lanka* ALEXANDER, Ann. Mag. Nat. Hist. (Part 105, in press).

Types, male and female, Tissewewa, Ceylon, altitude 30 feet, February 8, 1954 (*Schmid*).

Male.—Length, about 4 millimeters; wing, 4.

Female.—Length, about 4.5 millimeters; wing, 4.

General coloration of thorax dark brown; posterior border of scutellum and suture of the postnotum yellowed; pleura with a conspicuous whitened longitudinal stripe; femora brownish yellow, with a broad black subterminal ring, preceded and followed by white; posterior femur of male with a single

row of about 40 long curved erect setæ extending virtually over the entire length; wings (Plate 2, fig. 26) pale brown, variegated with whitened areas; Sc short, branches of Rs strongly divergent; abdominal tergites dark brown, the posterior borders conspicuously ringed with obscure whitish; male hypopygium (Plate 3, fig. 41) with two terminal dististyles, *d*, the outer very large, profoundly bifid; phallosome, *p*, with the elongate gonapophyses decussate at the midline.

GONOMYIA (LIPOPHLEPS) NEXOSA sp. nov. Plate 3, fig. 43.

Size small (wing of male 3 millimeters); mesonotal præscutum and scutum brown, posterior sclerites patterned with yellow; thoracic pleura light brown, with a yellowish white longitudinal stripe; legs light brown, femora slightly darker just before tips; wings tinged with brown, stigma slightly darkened; male hypopygium with the outer dististyle profoundly bifid into two slender arms; phallosome distinctive, with two pairs of appendages, including a slender crooklike spine and a long pale lobe that bears a dense brush of setæ at tip.

Male.—Length, about 3 millimeters; wing, 3.

Rostrum and palpi dark brown. Antennæ with scape and pedicel dark brown, more brightened above; flagellum brownish black, segments with very long verticils. Head light yellow; center of anterior vertex with a brown spot.

Prothorax and pretergites light yellow. Mesonotal præscutum and scutum almost uniformly brown, the former somewhat darker medially in front; pseudosutural foveæ brown; scutellum and posterior angles of scutal lobes yellowed; postnotum more reddened, yellow anteriorly, darker on posterior margin of mediotergite. Pleura chiefly light brown, with a conspicuous yellowish white longitudinal stripe from and including the fore coxæ, extending to base of abdomen; dorsopleural membrane light yellow. Halters yellow, including a line on the otherwise darkened knob. Legs with the coxæ and trochanters yellow; remainder of legs light brown, femora slightly darker just before tips; posterior femora with erect setæ on posterior half, not arranged in a definite row as in *lanka* and some other species. Wings tinged with brown, prearcular and costal fields more yellowed; stigma and a cloud over cord very slightly darker than the ground; veins brownish yellow to light brown. Venation: Sc short, Sc_1 ending some distance before origin of Rs, Sc_2 near its tip; branches of Rs divergent, cell R_3 at margin

very extensive; cell 1st M_2 about as long as the distal section of vein M_3; m-cu at fork of M.

Abdominal tergites dark brown, the posterior borders of the segments narrowly paler; sternites pale; hypopygium brownish yellow. Male hypopygium (Plate 3, fig. 43) with the basistyle relatively small and compact, the mesal face with numerous long strong setæ, some setæ of outer apical part of the style even longer. Two dististyles, *d*, both terminal; outer style profoundly divided into two slender arms, both much longer than the basistyle, outer arm weakly expanded at tip, inner arm dilated just before midlength and here with a small darkened point, beyond which the arm narrows into an acute black spine; inner style elongate, with strong bristles, including a fasciculate pair at apex. Phallosome, *p*, very complicated, including an unpaired recurved spine and an outer pale membrane, as well as two pairs of gonapophyses (only those of one side shown in figure); one a very slender recurved crooklike spine, the second a long pale lobe that bears a dense brush of setæ at apex.

Habitat.—Nepal.

Holotype, male, Amlekhgang, altitude 1,690 feet, August 26, 1956 (*Coher & Joshi*). Paratopotype, sex?

This fly is very distinct in the structure of the male hypopygium, which has the outer dististyle profoundly bifid, somewhat as in the otherwise very different *Gonomyia* (*Lipophleps*) *lanka* Alexander, of Ceylon.

GONOMYIA (LIPOPHLEPS) PRATAPI sp nov. **Plate 3, fig. 44.**

Size small (wing of male 3 millimeters); mesonotal præscutum and scutum brownish gray, pleura with a conspicuous whitened longitudinal stripe; legs light brown; wings weakly tinged with brown, without pattern; Sc short, branches of Rs strongly divergent; male hypopygium with two dististyles, the outer a simple rod, inner style bispinous; phallosome with the gonapophyses scabrous before the blackened spinelike tips.

Male.—Length, about 2.8 millimeters; wing, 3.

Rostrum brownish black; palpi black. Antennæ with the scape and pedicel black, restrictedly patterned with obscure yellow, flagellum black; flagellar segments elongate-cylindrical, with very long verticils. Head yellow, the center of the vertex dark brown.

Pronotum and proepisternites whitened. Mesonotal præscutum and scutal lobes brownish gray, without pattern, pseudosutural

foveæ transverse, dark reddish brown; posterior ends of scutal lobes and border of scutellum yellow; postnotal mediotergite yellow anteriorly, more reddened behind. Pleura and pleurotergite chiefly reddish brown, the former with a conspicuous whitened longitudinal stripe extending from behind the fore coxæ to the base of abdomen, narrowly bordered both above and beneath by darker. Halteres with stem and apex of knob yellowed, the base of latter weakly darkened. Legs with coxæ and trochanters pale; femora light brown or yellowish brown, unpatterned; outer segments broken. Wings weakly tinged with brown, without pattern; costal and prearcular regions more yellowed; veins pale brown, somewhat lighter in the brightened fields. Venation: Sc short, Sc_1 ending a distance before origin of Rs about equal to two-thirds the latter; branches of Rs strongly divergent, cell R_3 at margin more than three times cell R_2; cell R_5 narrowed at margin; 1st M_2 strongly narrowed at base; m-cu at fork of M.

Abdomen reddish brown, without distinct pattern; hypopygium more yellowed. Male hypopygium (Plate 3, fig. 44) with the dististyles, *d*, two, terminal; outer style a simple gently curved darkened rod, the tip obtuse, surface glabrous, base pale, dilated; inner style distinctive, bispinous, the spines short, black, long-conical, subequal in size, the outer at tip of a long curved arm that bears several strong setæ, with more delicate setulæ before the spine; second spine near base of outer margin, on a short basal tubercle that bears small setulæ. Phallosome, *p*, with the paired gonapophyses elongate, each terminating in a long black spine, the surface back from tip with appressed scabrous points; an unpaired central organ includes the ædeagus, the tip microscopically scabrous or spiculose, with a lateral blackened point.

Habitat.—Nepal.

Holotype, male, Nayagaon, August 3, 1956 (*Pratap Singh*).

The species is named for the collector, Mr. Pratap Singh, who was associated with Dr. Coher in the work of the World Health Organization. The fly is quite distinct from other regional members of the subgenus, including *Gonomyia* (*Lipophleps*) *flavomarginata* Brunetti, in the structure of the male hypopygium, especially the inner dististyle and phallosome.

GYMNASTES (PARAGYMNASTES) SIMHALÆ Alexander. Plate 2, fig. 27; Plate 3, fig. 46.

Gymnastes (*Paragymnastes*) *simhalæ* ALEXANDER, Ann. Mag. Nat. Hist. (Part 105, in press).

Types from various stations in Ceylon, altitude 2,000 to 2,700 feet, January, 1954 (*Schmid*).

Male.—Length, about 5.8 to 6 millimeters; wing, 5.8 to 6.

General coloration polished obscure yellow and black; head polished yellow, the center of the posterior vertex with a major brown area; apex of knob of halteres yellow; legs black, femoral bases and a subterminal ring yellow; wings (Plate 2, fig. 27) dark brown, the base and two narrower outer crossbands whitened; cell M_2 open by atrophy of basal section of M_3; male hypopygium (Plate 3, fig. 46) with the outer dististyle, *d*, slender, obtuse at tip, on outer margin with two unusually long yellow setæ; inner style a very massive blackened subglobular structure, on outer margin with a single short seta.

GYMNASTES (PARAGYMNASTES) KANDYANA Alexander. **Plate 2, fig. 28.**

Gymnastes (*Paragymnastes*) *kandyana* ALEXANDER, Ann. Mag. Nat. Hist. (Part 105, in press).

Type, male, Kandy, Ceylon, altitude 2,000 feet, January 14, 1954 (*Schmid*).

Male.—Length, about 4.5 millimeters; wing, 4.5.

Size relatively small (wing of male 4.5 millimeters); antennæ with pedicel and flagellum black; mesonotal præscutum with the stripes completely fused to form a discal shield, scutellum obscure yellow, pleura chiefly blackened; femora yellow basally, the tips broadly blackened, with a more diffuse darkened ring at near midlength; wings (Plate 2, fig. 28) with the ground whitened, patterned with relatively narrow darkened bands; veins R_3 and R_4 divergent, cells R_2 and R_3 at margin subequal; abdomen uniformly dark brown, hypopygium yellowed; male hypopygium with the outer dististyle small, very slightly dilated on outer half; ædeagus relatively short, terminating in a blackened point.

GYMNASTES (PARAGYMNASTES) MAYA Alexander. **Plate 3, fig. 45.**

Gynastes (*Paragynastes*) *maya* ALEXANDER, Am. Mag. Nat. Hist. (Part 105, in press).

Types, males, Kandy, Ceylon, altitude 2,000 feet, January 14, 1954 (*Schmid*).

Male.—Length, about 6.5 to 7 millimeters; wing, 6 to 6.5.

Size large (wing of male 6 millimeters or more); præscutum with three fulvous stripes, the central one divided by a capillary black line; pleura polished yellow, variegated with brown; femora yellow, with two darker rings; wings yellow, with a

conspicuous brown pattern, cell M_2 open; abdominal tergites bicolored, dark brown, ringed posteriorly with yellow; male hypopygium (Plate 3, fig. 45)with the inner margin of the basistyle, *b*, extensively blackened and corrugated; outer dististyle, *d*, greatly expanded outwardly.

RHABDOMASTIX (RHABDOMASTIX) SCHMIDIANA Alexander. Plate 2, fig. 29.

Rhabdomastix (*Rhabdomastix*) *schmidiana* ALEXANDER, Ann. Mag. Nat. Hist. (Part 105, in press).

Types from numerous stations in Ceylon.

Male.—Length, about 6 millimeters; wing, 7; antenna, about 26 to 27.

Female.—Length, about 6 millimeters; wing, 6.5; antenna, about 1.5.

General coloration of mesonotum light brown, darker medially and on sides; antennæ of male very long, exceeding three times the wing, yellow; wings (Plate 2, fig. 29) subhyaline, distinctly patterned with brown spots in the radial field; vein R_2 strongly preserved; abdominal segments conspicuously bicolored, yellow, the posterior borders more narrowly dark brown; male hypopygium with the outer blade of gonapophysis very narrow.

This distinct fly was named in honor of Dr. Fernand Schmid, of Lausanne, Switzerland, to whom I am indebted for numerous crane-flies from West Africa, Iran, Pakistan, Kashmir, and Ceylon.

CRYPTOLABIS (BÆOURA) TRIQUETRA Alexander. Plate 2, fig. 30; Plate 4, fig. 48.

Cryptolabis (*Bæoura*) *triquetra* ALEXANDER, Ann. Mag. Nat. Hist. (Part 105, in press).

Type, male, Kitulgala, Ceylon, altitude 800 feet, March 2, 1954 (*Schmid*).

Male.—Length, about 3.5 millimeters; wing, 4.

Female.—Length, about 3.5 millimeters; wing, 4.

Size small (wing, 4 millimeters); general coloration gray, the præscutum with three more plumbeous gray stripes and a major black area on either side; legs black, vestiture short; wings (Plate 2, fig. 30) weakly tinged with gray, veins dark brown; R_{2+3} suberect to oblique, cell R_3 relatively broad; male hypopygium (Plate 4, fig. 48) with the posterior border of the large glabrous tergite, *t*, truncate, each outer lateral angle produced into a slender lobe; dististyle, *d*, appearing as a glabrous triangular blade, widened outwardly.

CHEILOTRICHIA (EMPEDA) PARATYTTHOS Alexander. **Plate 4, fig. 47**

Cheilotrichia (*Empeda*) *paratytthos* ALEXANDER, Journ. N.Y. Ent. Soc. (in press).

Types, Amlekhgang, Nepal, altitude 1,690 feet, July 30 to August 26, 1956 (*Coher*).

Male.—Length, about 1.6 to 1.8 millimeters; wing, 2.1 to 2.2.

Female.—Length, about 2.5 millimeters; wing, 2.5 to 2.6.

Size very small (wing of male about 2.2 millimeters); general coloration dark brownish gray or plumbeous; halteres with knobs obscure yellow; legs brown; wings tinged with gray, without pattern; wing veins unusually glabrous; vein R_3 almost erect, cell M_2 open by atrophy of m, m-cu at or close to fork of M; male hypopygium (Plate 4, fig. 47) with the dististyles long and slender.

ERIOPTERA (ILISIA) GRUMULA Alexander. **Plate 2, fig. 31; Plate 4, fig. 49.**

Erioptera (*Ilisia*) *grumula* ALEXANDER, Journ. N. Y. Ent. Soc. (in press).

Types from Sleepy Hollow, altitude 7,900 feet, and Simbhanjang Pass, Nepal, altitude 8,190 feet, October 1, 1956 (*Coher & Joshi*).

Male.—Length, about 4.8 to 5 millimeters; wing, 5.5 to 5.8.

Female.—Length, about 5.5 millimeters; wing, 5.3 to 6.2.

General coloration buffy brown to gray, mesonotal præscutum with three darker brownish gray stripes; antennæ black, first flagellar segment yellowed; halteres pale yellow; legs brownish yellow, tarsi darker; wings (Plate 2, fig. 31) almost uniformly light yellow, stigma slightly darker; cell 1st M_2 small, veins M_3 and M_4 turned strongly upward at outer ends; male hypopygium (Plate 4, fig. 49) with the outer dististyle, *d*, blackened, compact, with a spiculose outer arm and an inner acute projection; inner style pale, bent strongly at near mid-length; phallosome, *p*, with two pairs of slender simple rods, one conspicuously hairy, the other glabrous.

ERIOPTERA (ERIOPTERA) IMPENSA Alexander. **Plate 4, fig. 50.**

Erioptera (*Erioptera*) *impensa* ALEXANDER, Journ. N. Y. Ent. Soc. (in press).

Types from Sleepy Hollow, altitude 7,900 feet, and Simbhanjang Pass, Nepal, altitude 8,190 feet, October 1, 1956 (*Coher*).

Male.—Length, about 6.5 millimeters; wing, 7.

Female.—Length, about 7 to 7.5 millimeters; wing, 8 to 9.

Size very large (wing of male 7 millimeters, of female 8

or more); general coloration of thorax light gray and brown; basal segments of antennæ reddish yellow, remainder of flagellum black; knobs of halteres brownish black; femora yellow, passing into brown; wings strongly yellowed, with a conspicuous brown seam over the cord; male hypopygium (Plate 4, fig. 50) with the posterior border of tergite, *t*, unequally trilobed, the margins scabrous; inner dististyle, *d*, a narrow glabrous blade, inner style recurved at tip.

MOLOPHILUS (TASIOCERELLUS) KANDYENSIS Alexander. **Plate 4, fig. 51.**

Molophilus (*Tasiocerellus*) *kandyensis* ALEXANDER, Ann. Mag. Nat. Hist. (Part 105, in press).

Types, males, from Kandy, Ceylon, altitude 2,000 feet, January 14, 1954 (*Schmid*).

Male.—Length, about 3 millimeters; wing, 3.5; antenna, about 0.4.

Size very small (wing of male 3.5 millimeters); antennal verticils very long; wings with Sc_1 relatively short; R_{2+3+4} preserved but very short, R_2 and R_{2+3} in approximate transverse alignment; cell M_2 open, cell M_3 short; all cells of wing with abundant long trichia; male hypopygium (Plate 4, fig. 51) interpreted as having two dististyles, *d*, the outer very large and stout, exceeding the area of the basistyle; inner style elongate, directed caudad, interconnected across the genital chamber by a narrow semilunar blackened bridge, more outwardly with pale membrane that is densely beset with small separated groups of setulæ; phallosomic plate, *p*, long and narrow, microscopically setulose except at apex.

MOLOPHILUS (MOLOPHILUS) RACHIUS Alexander. **Plate 4, fig. 52.**

Molophilus (*Molophilus*) *rachius* ALEXANDER, Ann. Mag. Nat. Hist. (Part 105, in press).

Types, males and females, Ambawela, Ceylon, altitude 6,000 feet, March 4, 1954 (*Schmid*).

Male.—Length, about 3.5 millimeters; wing, 4.2; antenna, about 4.

Female.—Length, about 4 millimeters; wing, 5.

Belongs to the *gracilis* group, *procericornis* subgroup; general coloration very pale yellowish brown; antennæ of male very long, nodulose, nearly equal in length to the wing; flagellar segments swollen basally and here provided with long erect setæ; male hypopygium (Plate 4, fig. 52) with the basistyle, *b*, at apex produced caudad into a long slender lobe that narrows into a long acute spine, inner apical lobe small; two very un-

equal dististyles, *d*, one long and slender, virtually glabrous, the other very small, abruptly narrowed at apex into a slender lobe.

MOLOPHILUS (MOLOPHILUS) VEDDAH sp. nov. **Plate 4, fig. 53.**

Belongs to the *gracilis* group, *procericornis* subgroup; general coloration of mesonotum light fulvous; antennæ of male relatively long, about two-thirds the wing, flagellar segments with relatively short apical necks, the dilated bodies of the segments with long outspreading setæ; male hypopygium with the outer apical lobe of basistyle a slender sinuous rod that narrows into an acute spine; basal lobe flattened, its margin weakly bilobed, provided with strong setiferous tubercles.

Male.—Length, about 3.3 millimeters; wing, 4; antenna, about 2.7.

Rostrum and palpi black. Antennæ dark brown, the apical pedicels of the more proximal flagellar segments a trifle paler; flagellar segments fusiform, with glabrous apical necks that are shorter than in *wejaya;* dilated bases with conspicuous whorls of erect setæ, as in many species of the subgenus and subgroup. Head brownish gray.

Pronotum weakly darkened. Mesonotum almost uniformly light fulvous. Pleura fulvous yellow, a trifle darkened dorsally. Halteres darkened, base of stem yellow. Legs with coxæ and trochanters pale yellow; remainder of legs more obscure yellow, outer tarsal segments brownish black. Wings tinged with grayish yellow, the base clearer yellow; veins light brown, macrotrichia darker. Venation: R_2 in transverse alignment with r-m; petiole of cell M_3 nearly four times m-cu; vein 2nd A short and virtually straight, ending a short distance before level of m-cu.

Abdomen dark brown, hypopygium large, brownish yellow, the styli brownish black. Male hypopygium (Plate 4, fig. 53) generally as in *wejaya* but differing in all details. Outer apical lobe of basistyle, *b*, a slender sinuous rod that narrows into an acute spine; inner apical lobe a triangular blade with a slender stem, the outer margin with string setæ; basal lobe more flattened than in *wejaya,* the margin vaguely bilobed, each lobe with strong setiferous tubercles. Dististyles, *d*, terminal, the slightly longer inner style terminating in a stout spine, the outer style with the base dilated, tip subobtuse. Ædeagus moderately long, base not conspicuously expanded.

Habitat.—Ceylon.

Holotype, male, Nuwara Eliya, altitude 6,000 feet, March 1, 1954 (*Schmid*).

The specific name, *Veddah*, is that of a native tribe of Ceylon, evidently derived from the aboriginal Yakkho. The nearest regional ally is the species next described as *Molophilus* (*Molophilus*) *wejaya*, which differs especially in the structure of the male hypopygium, particularly the lobes of the basistyle.

MOLOPHILUS (MOLOPHILUS) WEJAYA sp. nov. **Plate 4, fig. 54.**

Belongs to the *gracilis* group, *procericornis* subgroup; general coloration of thoracic notum reddish yellow, dorsal pleurites darkened; antennæ of male elongate, about three-fourths the wing, flagellum nodulose, the segments with long outspreading setæ; male hypopygium with the outer apical lobe of basistyle truncate at tip, inner apical lobe a short-stemmed blade, basal lobe oval; dististyles two, terminal in position, one produced into a long black spine.

Male.—Length, about 3.5 millimeters; wing, 4; antenna, about 3.

Female.—Length, about 4 millimeters; wing, 4.5.

Rostrum and palpi brownish black. Antennæ of male elongate, as shown by the measurements, brownish black, the apices of the segments paler; bases of segments fusiform, outer ends produced into glabrous necks, the dilated part with whorls of very long outspreading setæ that exceed the segments. Head brown.

Pronotum dark brown. Mesonotum reddish yellow, without pattern, in the female the pleura concolorous, in the holotype male the dorsal pleurites and membrane darker brown to form a stripe. Halteres weakly darkened. Legs yellow, the tips of the femora and tibiæ narrowly and vaguely darkened, the outer tarsal segments darker. Wings grayish yellow, prearcular and costal fields clearer yellow; veins brownish yellow, trichia brown. Venation: R_2 about in transverse alignment with r-m; petiole of cell M_3 long, in the male about five times the short m-cu, in the female only about three times as long; vein 2nd A ending shortly before level of m-cu.

Abdomen dark brown, hypopygium large, slightly more yellowish brown. Male hypopygium (Plate 4, fig. 54) with the outer apical lobe of basistyle, *b*, subequal in length to the dististyles and stouter, the tip obliquely truncated; inner apical lobe a short-stemmed triangularly dilated blade, its apex oblique, with numerous setæ; basal lobe small, oval, compact, with strong

setæ. Dististyles, *d*, terminal, one shorter, narrowed into a long black spine, the other style uniformly pale, almost straight, the tip subacute or narrowly obtuse. Ædeagus moderately long, expanded at base, the acute tip very slender.

Habitat.—Ceylon.

Holotype, male, Ambawela, altitude 6,000 feet, March 4, 1954 (*Schmid*).

The specific name, *Wejaya*, is that of the first sovereign of Ceylon, 543 B.C. The female may prove to be of a different species from the type since it differs somewhat in venation and in body coloration. It may possibly prove to be the female of *Molophilus* (*Molophilus*) *veddah* sp. nov. The various Ceylonese species of the *procericornis* subgroup herein described are most readily separated among themselves by the structure of the male antennæ and hypopygium, in the latter particularly the dististyles and lobes of the basistyle.

MOLOPHILUS (MOLOPHILUS) YAKKHO sp. nov. **Plate 4, fig. 55.**

Belongs to the *gracilis* group, *procericornis* subgroup; general coloration dark brown; antennæ moderately long, the flagellar segments of the male elongate but not produced into glabrous apical necks, the bases with long outspreading setæ and verticils; male hypopygium with the outer apical lobe of basistyle terminating in a short acute spine, inner apical lobe slender, basal lobe narrowed outwardly; both dististyles terminating in spines, the outer style more scabrous.

Male.—Length, about 3.3 to 3.5 millimeters; wing, 3.8 to 4.2; antenna, about 2 to 2.1.

Female.—Length, about 4 to 4.8 millimeters; wing, 4.5 to 5.

Rostrum and palpi dark brown. Antennæ of male brownish black throughout, relatively short for a member of this subgroup; flagellar segments elongate-fusiform, the ends truncated, the outer end not produced into a neck, the entire surface setiferous, with long outspreading setæ and verticils that are more restricted to the dilated central part; in female, antennæ shorter but still relatively elongate. Head dark brown.

Prothorax and mesothorax almost uniformly dark brown, the præscutum with a central darker vitta; humeral region of præscutum and the anterior pretergites obscure yellow. Halteres infuscated, base of stem narrowly yellow. Legs with the coxæ infuscated, trochanters a trifle paler; remainder of legs brown, appearing darker by reason of the dense vestiture, femoral bases restrictedly more brightened. Wings with a

weak dusky tinge, veins and trichia darker. Venation: R_2 shortly before level of r-m; petiole of cell M_3 more than four times m-cu; vein 2nd A long and gently sinuous, ending some distance beyond the level of m-cu.

Abdomen, including hypopygium, dark brown. Male hypopygium (Plate 4, fig. 55) with the outer apical lobe of basistyle, *b*, stout, narrowed at tip into a short acute spine, setiferous virtually to the tip; inner apical lobe slender, only slightly larger at outer end and here with seven or eight setæ; basal lobe narrowed outwardly, tip obtuse, the lower margin of outer half with long slightly recurved spinelike setæ. Dististyles, *d*, terminal, the outer a slender spine, narrowed very gradually into a long spine, surface of outer two-thirds with abundant scabrous points, those of the lower or inner face larger; inner style shorter but stouter, sinuous, narrowed to an acute point, the outer fourth before the spine with relatively few microscopic spicules. Ædeagus of moderate length. Phallosomic plate obtuse at tip, with microscopic setulæ.

Habitat.—Ceylon.

Holotype, male, Horton Plains, altitude 6,800 feet, March 7, 1954 (*Schmid*). Allotopotype, female, pinned with the type. Paratypes, 1 male, 1 female, Nuwara Eliya, altitude 6,000 feet, February 26, 1954 (*Schmid*).

The specific name, *Yakkho,* is that of the aborigines of Ceylon, presumed to be ancestral to the modern Veddahs. *Molophilus* (*Molophilus*) *yakkho* is undoubtedly a member of the *procericornis* subgroup but has the antennæ unusually short and the flagellar segments but slightly modified. It is readily told from the other regional species described herewith by the nature of the antennæ and the structure of the male hypopygium.

STYRINGOMYIA OBSCURA Brunetti. **Plate 2, fig. 32; Plate 4, fig. 56.**

Styringomyia obscura BRUNETTI, Rec. Ind. Mus. 6 (1911) 300.
Styringomyia obscura BRUNETTI, Fauna Brit. India, Dipt. Nematocera (1912) 463–464.
Styringomyia obscura EDWARDS, Trans. Ent. Soc. London 1914 (1914) 213, figs. 46, 47 (ovipositor).

The type, a female (considered by Brunetti as being a male), from Thamaspur, Nepal.

Nepal: Amlekhgang, altitude 1,690 feet, June 9, 1956 (*Coher*); Bhimpedi, altitude 3,500 feet, February 27, 1956 (*Coher & Joshi*).

The present material agrees well with the description of the type except that the black color of the legs is more extensive, the femora being chiefly black, with the bases and a narrow subterminal ring yellow. The fact that the wing (Plate 2, fig. 32) was slightly patterned was discussed by Edwards. The nearest ally is *Styringomyia schmidiana* Alexander, of Kashmir, which has the structure of the male hypopygium quite distinct. I am making one of the specimens now available an allotype of the species.

Male hypopygium (Plate 4, fig. 56) with the tergite, *t*, terminating in a triangular cushion, densely covered with yellow setæ, terminating in a slender point. Sternite, *s*, extended into a slender outer part, bearing two apical bristles, the distal end with microscopic erect setulæ. Basistyle, *b*, with a single modified seta, from a long basal tubercle. Dististyle, *d*, with the outer arm unusually slender, with about four small setæ on central part; intermediate arm a flattened blade, the disk and margins with blackened pegs, arranged approximately as in figure; inner arm a slender sinuous blade, with two separate groups of pegs, both on basal half of arm, the more proximal group on the disk, including about six longer pegs, the second group on outer margin, including a linear series; innermost arm of style long and slender, provided with very long black setæ. Phallosome, *p*, including a strong blackened central ædeagus, with a pair of microscopic black points lying more basally.

Allotype, male, Amlekhgang, Nepal, altitude 1,690 feet, June 9, 1956 (*Coher*).

STYRINGOMYIA NEPALENSIS Edwards. **Plate 4, fig. 57.**

Styringomyia nepalensis Edwards, Trans. Ent. Soc. London 1914 (1914) 222, *figs. 42, 43* (♂ hypopygium), *78, 79* (ovipositor).

The types were from Sukhwani, Nepal.

Nepal: Amlekhgang, Nepal, altitude 1,690 feet, June 9, 1956 (*Coher*).

The male hypopygium was not described by Edwards and the figures in his paper by Hentschel, while sufficiently accurate in their general features, do not show sufficiently the details of the dististyle.

Male hypopygium (Plate 4, fig. 57) with the tergite, *t*, terminating in a triangular cushion. Sternite, *s*. long and slender, pale, terminating in two strong setæ. Basistye, *b*, with a single modified seta, arising from a slightly shorter pale basal

tubercle. Dististyle, *d*, having the outer arm with two small setæ on inner margin beyond midlength; intermediate arm low, expanded outwardly, the margin concave, provided with numerous black pegs or short spines; lower arm a curved rod that is narrowed outwardly, with about seven or eight blackened pegs, the three outermost longer, at base of rod with four or five long setæ; inner lobe a circular darkened blade. Phallosome, *p*, with a strong central blackened blade, bent at a right angle into a spine, more basad with two appressed small spines.

ILLUSTRATIONS

[Legend: *a*, ædeagus; *b*, basistyle; *d*, dististyle; *g*, gonapophysis, *s*, sternites, *t*, tergites.]

Plate 1

Fig. 1. *Dolichopeza* (*Nesopeza*) *palifera* sp. nov.; venatoin.
2. *Dolichopeza* (*Nesopeza*) *guttulanalis* sp. nov.; venation.
3. *Dolichopeza* (*Nesopeza*) *singhalica* sp. nov.; venation.
4. *Cylindrotoma nigritarsis* Alexander; venation.
5. *Lechria argentosigna* sp. nov.; venation.
6. *Limonia* (*Limonia*) *illumina* sp. nov.; venation.
7. *Limonia* (*Discobola*) *euthenia* sp. nov.; venation.
8. *Limonia* (*Dicranomyia*) *lakshmi* sp. nov.; venation.
9. *Limonia* (*Pseudoglochina*) *periscelis* sp. nov.; venation.
10. *Antocha* (*Orimargula*) *salikensis* sp. nov.; venation.
11. *Nipponomyia joshii* Alexander; venation.
12. *Dicranota* (*Eudicranota*) *dione* Alexander; venation.
13. *Ula* (*Ula*) *subbidens* sp. nov.; venation.
14. *Paradelphomyia* (*Oxyhiza*) *subterminalis* sp. nov.; venation.
15. *Polymera* (*Polymera*) *zeylanica* sp. nov.; venation.
16. *Pseudolimnophila* (*Pseudolimnophila*) *zelania* sp. nov.; venation.

Plate 2

Fig. 17. *Eupilaria thysanotos* sp. nov.; venation.
18. *Hexatoma* (*Eriocera*) *coheri* Alexander; venation.
19. *Hexatoma* (*Eriocera*) *serendib* sp. nov.; venation.
20. *Gonomyia* (*Ellipteroides*) *thiasodes* Alexander; venation.
21. *Gonomyia* (*Ellipteroides*) *pictilis* Alexander; venation.
22. *Gonomyia* (*Ellipteroides*) *rohuna* Alexander; venation.
23. *Gonomyia* (*Idiocera*) *persimilis* Alexander; venation.
24. *Gonomyia* (*Idiocera*) *petilis* sp. nov.; venation.
25. *Gonomyia* (*Gonomyia*) *serindibensis* Alexander; venation.
26. *Gonomyia* (*Lipophleps*) *lanka* Alexander; venation.
27. *Gymnastes* (*Paragymnastes*) *simhalæ* Alexander; venation.
28. *Gymnastes* (*Paragymnastes*) *schmidiana* Alexander; venation.
29. *Rhabdomastix* (*Rhabdomastix*) *schmidiana* Alexander; venation.
30. *Cryptolabis* (*Bæoura*) *triquetra* Alexander; venation.
31. *Erioptera* (*Ilisia*) *grumula* Alexander; venation.
32. *Styringomyia obscura* Brunetti; venation.

Plate 3

Fig. 33. *Dolichopeza* (*Nesopeza*) *guttulanalis* sp. nov.; male hypopygium.
34. *Dolichopeza* (*Nesopeza*) *palifera* sp. nov.; male hypopygium.
35. *Limonia* (*Discobola*) *euthenia* sp. nov.; male hypopygium.
36. *Limonia* (*Limonia*) *illumina* sp. nov.; male hypopygium.
37. *Limonia* (*Dicranomyia*) *lakshimi* sp. nov.; male hypopygium.
38. *Gonomyia* (*Ellipteroides*) *pictilis* Alexander; male hypopygium.
39. *Gonomyia* (*Gonomyia*) *serindibensis* Alexander; male hypopygium.

40. *Gonomyia* (*Idiocera*) *petilis* sp. nov.; male hypopygium.
41. *Gonomylia* (*Lipophleps*) *lanka* Alexander; male hypopygium.
42. *Gonomyia* (*Lipophleps*) *hedys* Alexander; male hypopygium.
43. *Gonomyia* (*Lipophleps*) *nexosa* sp. no.; male hypopygium.
44. *Gonomyia* (*Lipophleps*) *pratapi* sp. nov.; male hypopygium.
45. *Gymnastes* (*Paragymnastes*) *maya* Alexander; male hypopygium.
46. *Gymnastes* (*Paragymnastes*) *simhalæ* Alexander; male hypopygium.

PLATE 4

FIG. 47. *Cheilotrichia* (*Empeda*) *paratytthos* Alexander; male hypopygium.
48. *Cryptolabis* (*Bæoura*) *triquetra* Alexander; male hypopygium.
49. *Erioptera* (*Ilisia*) *grumula* Alexander; male hypopygium.
50. *Erioptera* (*Erioptera*) *impensa* Alexander; male hypopygium.
51. *Molophilus* (*Tasiocerellus*) *kandyensis* Alexander; male hypopygium.
52. *Molophiluc* (*Molophilus*) *rachius* Alexander; male hypopygium.
53. *Molophilus* (*Molophilus*) *veddah* sp. nov.; male hypopygium.
54. *Molophilus* (*Molophilus*) *wejaya* sp. nov.; male hypopygium.
55. *Molophilus* (*Molophilus*) *yakkho* sp. nov.; made hypopygium.
56. *Styringomyia obscura Bruneti;* male hypopygium.
57. *Styringomyia nepalensis* Edwards; male hypopygium.

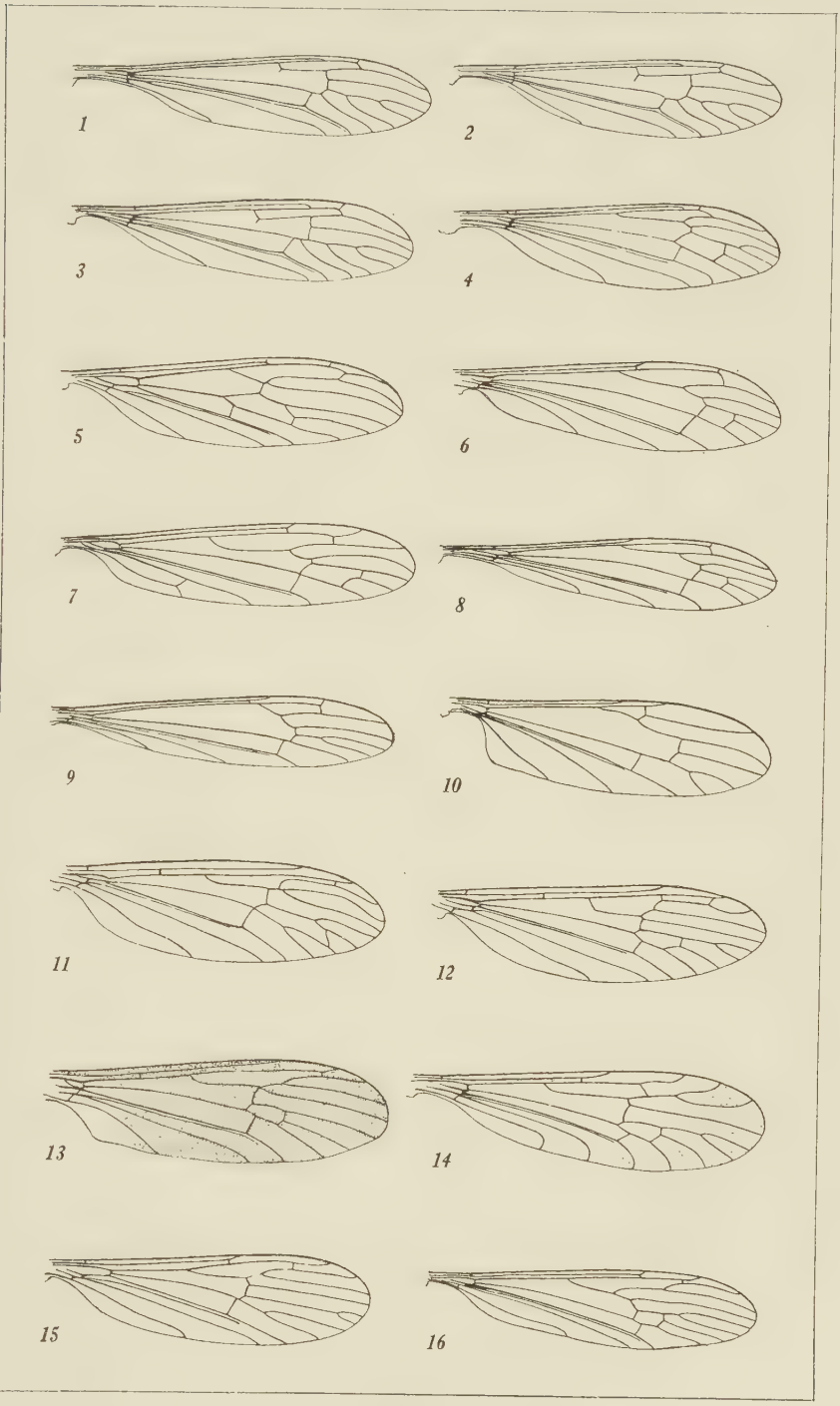

PLATE 1.

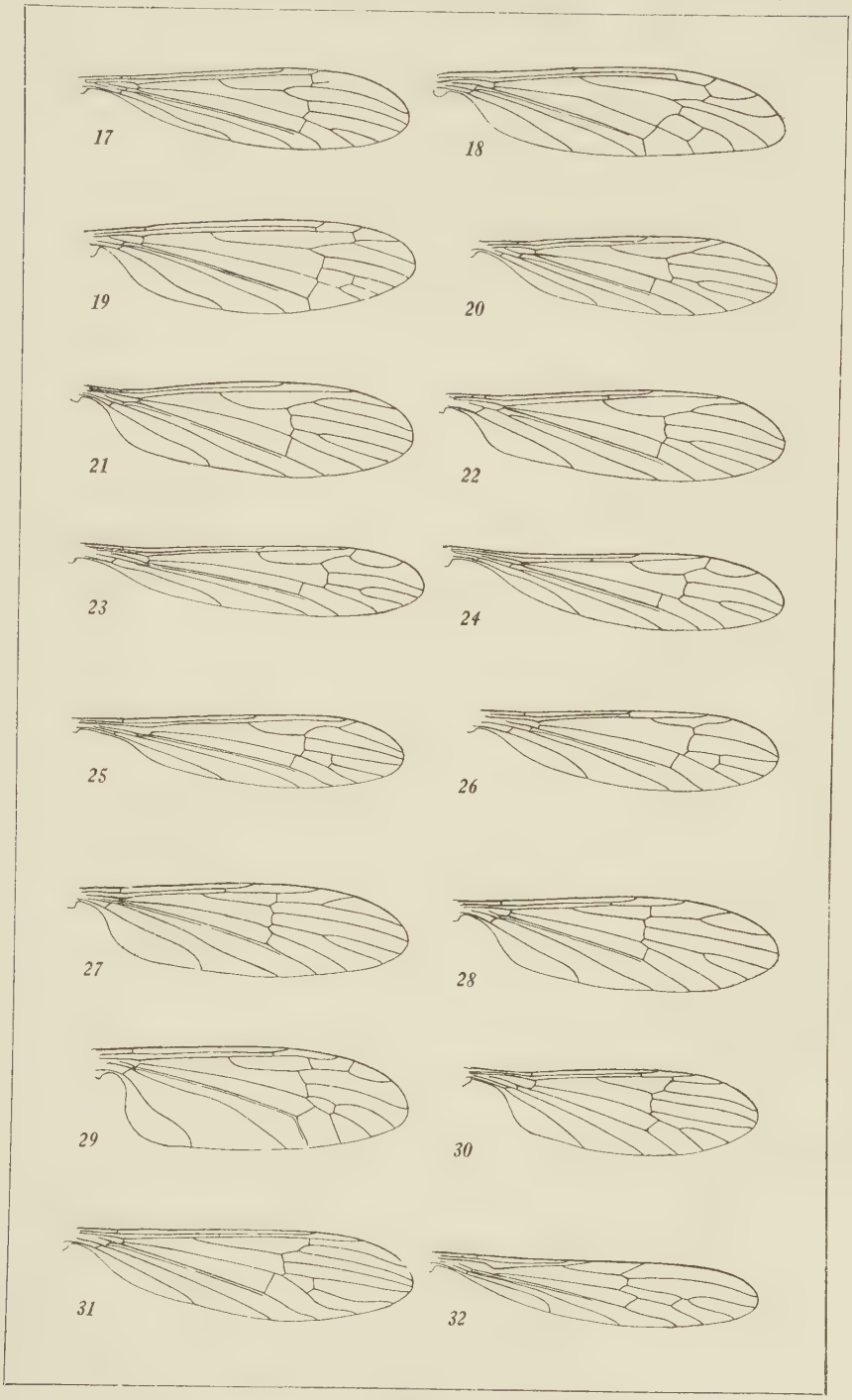

PLATE 2.

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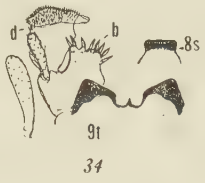

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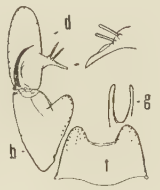

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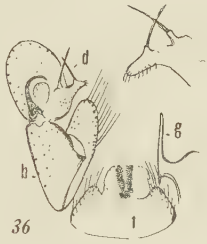

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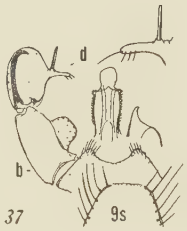

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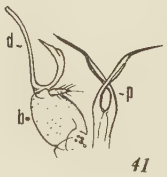

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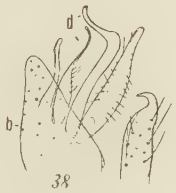

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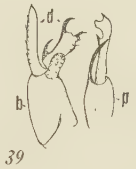

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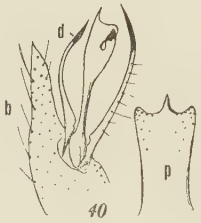

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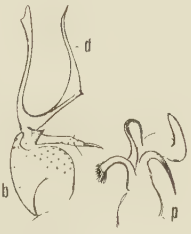

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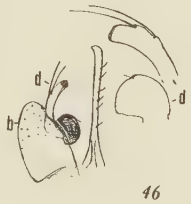

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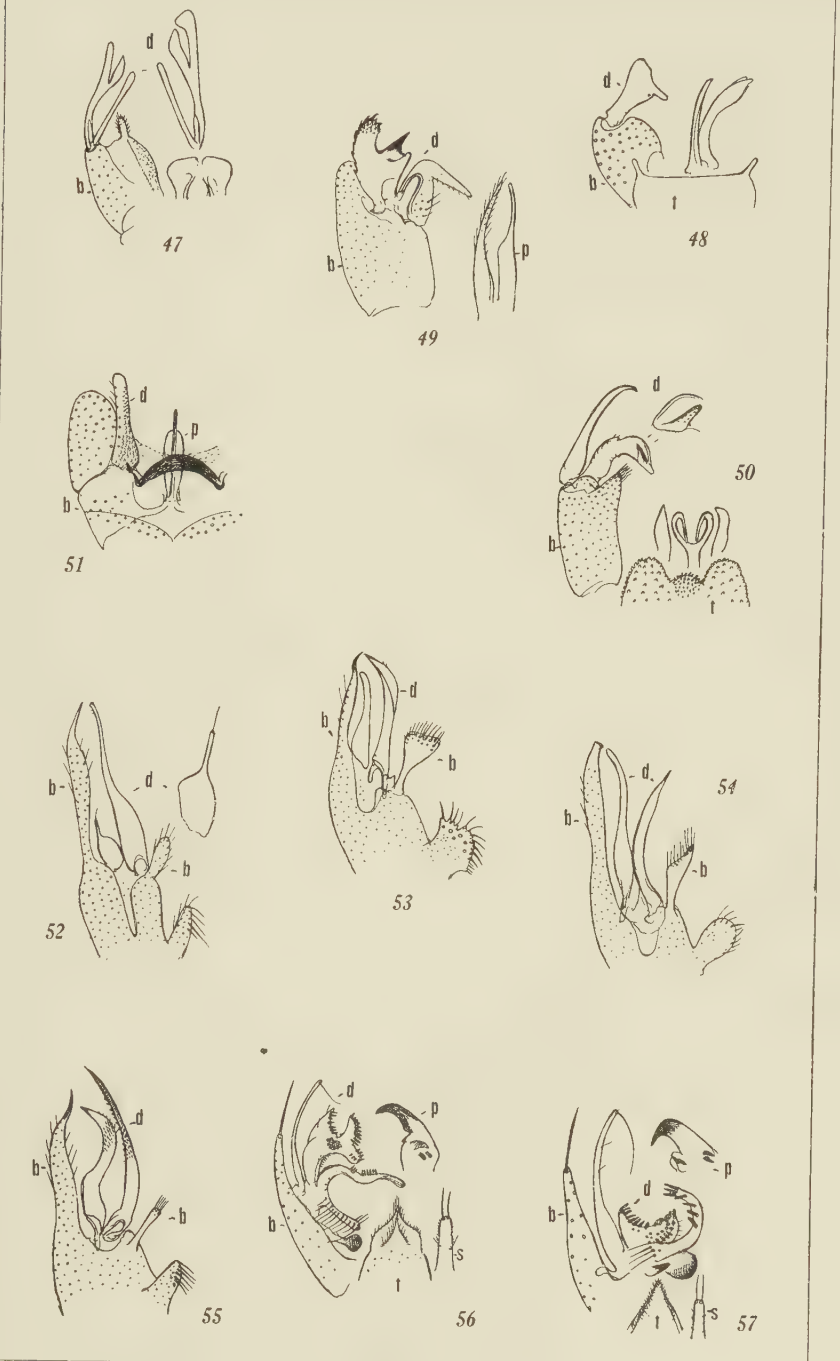
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